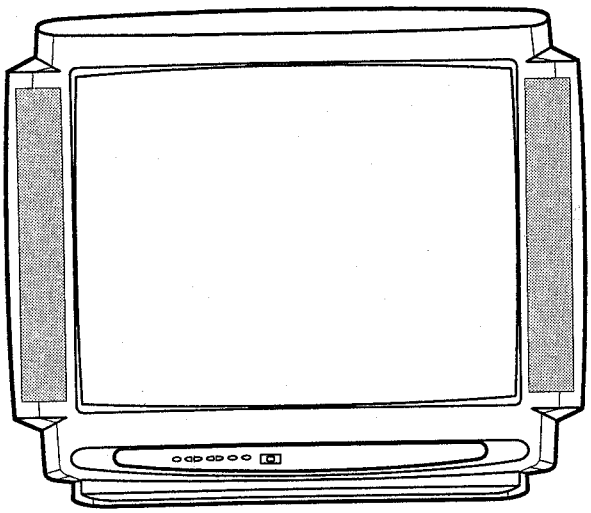
ORDER NO. MTC9506611A1
B5

# Service Manual

Color Television



All Models

| Panasonic Models | Chassis |
|---|---|
| CT–27G30T | AMEDP246 |
| CT–27G30CT | AMEDP246 |
| CT–27G30UT | AMEDP246 |
| CT–31G30T | ANEDP252 |
| CT–31G30UT | ANEDP252 |

## Main Manual (NA3D)

**NOTE:** ***Model CT–27G30UT is identical to CT–27G30T and model CT–31G30UT is identical to CT–31G30T, except for the magnetic field used in the factory to adjust purity and convergence for different markets.***

The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

"WARNING! This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non–technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

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# Important Safety Notice

There are special components used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X–RADIATION, shock, fire or other hazards. Do not modify the original design without the permission of manufacturer.

## Safety Precautions

### General Guidelines

An ISOLATION TRANSFORMER should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

When servicing observe the original lead dress, especially in the high voltage circuit. In case of a short circuit, replace every part which has overheated.

Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the receiver. Use only manufacturers recommended rating for fuses, circuit breakers, etc.

High potentials are present when this set is operating. Operation of the set without the rear cover involves the danger of electric shock from the set's power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high–voltage equipment.

Extreme care should be used in HANDLING THE PICTURE TUBE. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure in removal or installation. When handling, use safety goggles and heavy gloves for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from cold ground (i.e. dag ground lead) to anode with a well insulated piece of wire.

Avoid prolonged exposure at close range to unshielded areas of the picture tube. Possible danger of personal injury from unnecessary exposure to X–ray radiation may result.

The TEST PICTURE TUBE used for servicing the chassis at the bench should incorporate a safety glass and magnetic shield. The safety glass affords shielding from the tube viewing area against X–ray radiation as well as implosion protection. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that jig is capable of handling 31kV without causing X–radiation.

BEFORE RETURNING A SERVICED RECEIVER **(of any type)** TO THE OWNER, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

### Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and each exposed metallic part such as screw heads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. When the exposed metal does not have a return path to the chassis, the reading must be infinite.

### Leakage Current Hot Check (See Figure)

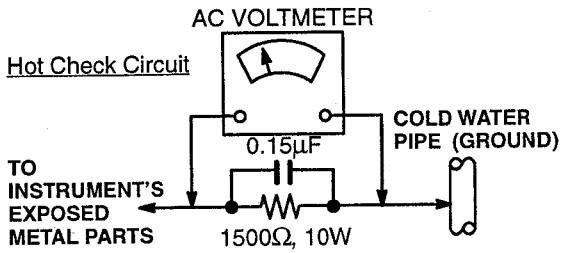
Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between each exposed metallic part and ground. Use an earth ground, for example a water pipe.

Using an AC voltmeter with 1000 ohms/volt or more sensitivity, measure the potential across the resistor.

Move the resistor connection to each exposed metallic part and measure the voltage present.

Check that any potential does not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above hot check, in which case any current measure must not exceed 1/2 milliamp. In case any measurement is out of the limits specified, there is a possibility of a shock hazard and the set must be repaired and rechecked before it is returned to the customer.




### X–Radiation

**WARNING:** The potential source of X–radiation in TV sets is the High Voltage section and the picture tube.

**NOTE:** It is important to use an accurate, periodically calibrated high voltage meter.

Adjust BRIGHTNESS, PICTURE, SHARPNESS and COLOR controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 29.25kV ±1.25kV. If the upper meter indication is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

### Horizontal Osc. Disable Circuit Test

This test must be made as a final check before the set is returned to the customer. See HORIZONTAL OSC. DISABLE CIRCUIT PROCEDURE CHECK in this manual.

# Specifications

| | |
|---|---|
| **Power Source:** | 120 volts, 60 Hz, AC |
| **Power Consumption:** | 2.0 amps Max. |
| **Antenna Terminal Impedance:** | (1) UHF/VHF 75Ω input |
| **Channel Capability:** | 181 Channels (Phase 18M1 Synthesizer) |
| **Off the Air:** | VHF 2~13, UHF 14~69 |
| **Cable:** | 125 Channels |

## INPUTS:

### All Models

| | |
|---|---|
| **(2) Video Input Jack:** | 1V p–p 75Ω, phono jack type |
| **(2 pairs) Audio Input Jack (L & R):** | 500mV RMS, High impedance–10k |
| **(1) S–Video Input:** | Round 4 pin S–Video connector (rear) |

## OUTPUTS:

| | |
|---|---|
| **Audio Out/Variable:** | 0~1V, RMS, 10k (30% modulation) |
| **Stereo Output Power:** | 3.5W x 3.5W (10% Distortion) |

## FEATURES:

| | |
|---|---|
| **AI Sound:** | This feature is used to enhance sound quality through automatic adjustment of Bass and Treble during Speech or Music segments of the audio broadcast. It also regulates the volume between program and commercial audio to maintain a constant sound output level. |
| **Surround Sound:** | This feature is used to enhance audio response when listening to stereo broadcasts. |
| **Comb Filter:** | Separates video signal from chroma |
| **PIP:** | (2 Tuner) Small inset picture of the another TV channel (Second tuner video) or of an External Video Input |
| **Notch Filter:** | Minimizes noise on the edges of colored images |
| **Closed Caption Viewing:** | Visual depiction of information contained in the audio portion of a television program. |
| **Remote Control:** | 2 Tuner Easicon Universal Infra–red system **Panasonic** (EUR501232) |

## PICTURE TUBE:

**27"** diagonal (Viewing area) 100 degree deflection **M68LGL061X**

**31"** diagonal (Viewing area) 110 degree deflection **M78JUA069X**

**Anode Voltage:** 30.5kV Max. (zero beam) 29.25kV (±1.25kV)

## DIMENSIONS:

**CT–27G30T; CT–27G30CT; CT–27G30UT**

**Height** – 23–15/32" (596mm)
**Width** – 30–7/32" (768mm)
**Depth** – 20–13/16" (529mm)
**Weight** – 80.5 lbs. (36.5 kg)

**CT–31G30T; CT–31G30UT**

**Height** – 25–3/4" (654mm)
**Width** – 34–9/32" (867mm)
**Depth** – 26–39/64" (676mm)
**Weight** – 114.5 lbs (51.9 kg)

Specifications are subject to change without notice or obligation. Dimensions and weight are approximate measurements.

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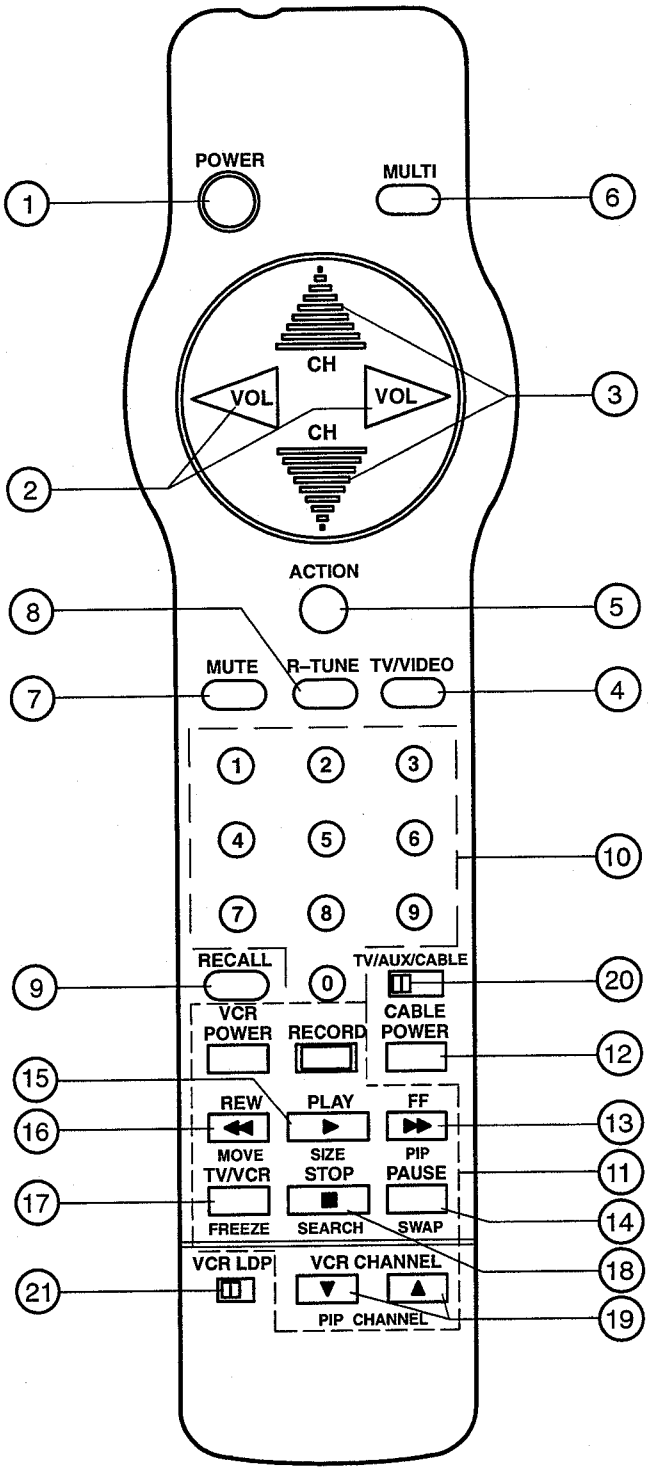
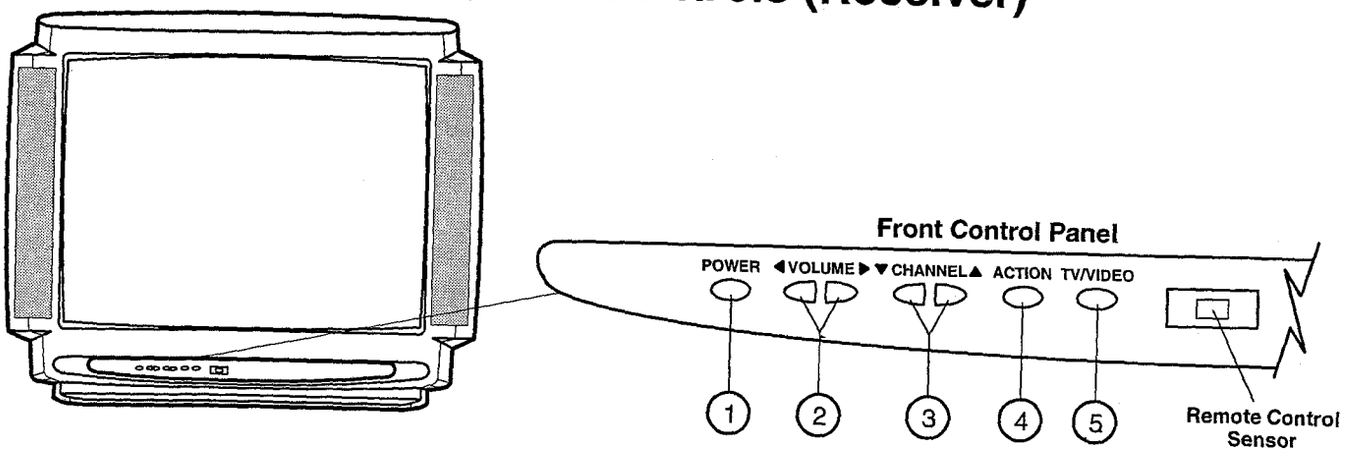
**Followed by 5 Large Separate Schematic Sheets With All Schematics, Waveforms, Voltage Charts, Notes, Printed Wiring Boards & Audio/Video Block Diagrams.**

# Location of Controls (Remote Control)



# Location of Controls (Receiver)




## Quick Reference Control Operation (Remote & Receiver)

(1) **Power Button** – Press to turn ON or OFF.

(2) **Volume Buttons** – Press to adjust Sound Level. Press to adjust Audio Menus, Video Menus and select operating features when menus are displayed.

(3) **Channel Buttons** – Press to select programmed channels. Press to highlight desired features when menus are displayed. Also used to select Cable Converter box channels after programming Remote Control Infra–red codes (the TV/AUX/CABLE switch must be set in CABLE position).

(4) **TV/Video Button** – Press to select TV or one of two Video Inputs, for the Main Picture or the PIP frame (when PIP frame is displayed).

(5) **Action Button** – Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

(6) **Multi Button** – Programmable to operate up to six Remote Function buttons.

(7) **Mute Button** – Press to mute sound. A second press returns sound.

(8) **R–Tune (Rapid Tune) Button** – Press to switch between two channels.

(9) **Recall Button** – Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.

(10) **Keyboard "0 through 9" Buttons** – Press desired channel number to access any channel.

(11) **VCR Function Buttons** – Programmable to operate many brands of VCRs.

(12) **Cable Power Button** – Programmable to operate selected CATV converter boxes.

(13) **PIP (Picture In Picture) Button** – Press to display the PIP frame, press again to remove PIP frame.

(14) **Swap Button** – Press to interchange PIP frame with Main Picture (when the PIP frame is displayed).

(15) **Size Button** – Press to select size of PIP frame (when the PIP frame is displayed).

(16) **Move Button** – Press to position PIP frame to any corner of the Main Picture (when PIP frame is displayed).

(17) **Freeze Button** – Press to stop action in the Main Picture or PIP frame (when the PIP frame is displayed).

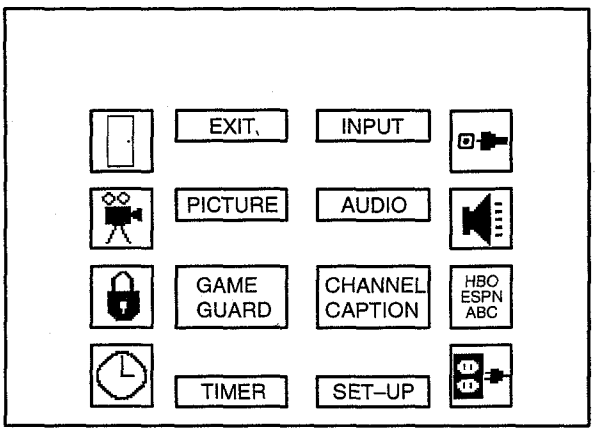
(18) **Search Button** – Press the SEARCH button to automatically scan channels which are programmed into memory. Press the SEARCH button again to delete Search frame.

(19) **PIP Channel Buttons** – When the PIP frame is displayed, press the PIP Channel (CH) UP button to select the next higher programmed channel in the PIP frame. Press the Channel (CH) DOWN button to select the next lower programmed channel in the PIP frame.

(20) **TV/AUX/CABLE Switch** – This switch is used to select the proper mode when programming Remote Control Infra red codes or operating the TV or external equipment (VCR, LDP or Cable TV Converter box).

(21) **VCR/LDP Switch** – This switch is used to select the proper mode when the TV/AUX/CABLE switch is in the AUX position to program the Remote Control Infra red codes or operate the auxiliary equipment (VCR, LDP).

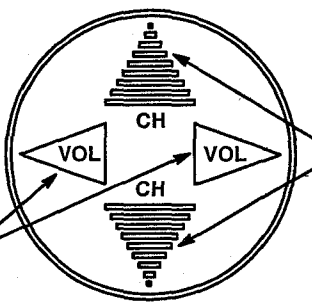
# Main Menu (Icons)




Located On Remote Control

**ACTION**

Displays and Exits Menus




Selects Desired Feature When Menu is Displayed

*Selects or Adjusts Features When Menu is Displayed*

1. Press the ACTION button to display the Main Menu with Icons.
2. Press the CH UP or DOWN and the VOL LEFT or RIGHT buttons to select the desired Icon when the Main Menu is displayed (selected Icon will be indicated in Red).
3. Press the VOL buttons for left and right movement and the CH buttons for up or down movement.
4. To exit the Main Menu first select the EXIT Icon, then press the ACTION button.

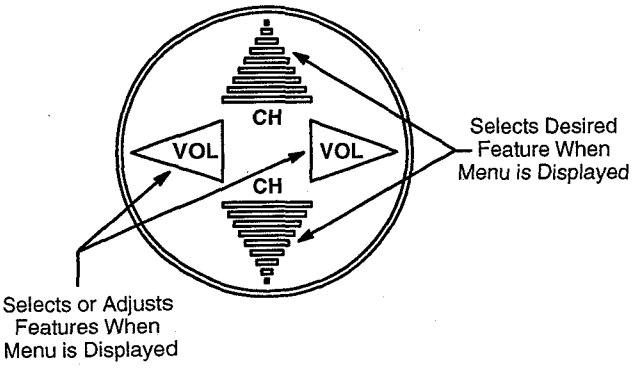
# Feature Operation

## Input Select

- Main Picture Input Selection
- PIP (Picture in Picture) Input Selection

Displays and Exits Menus

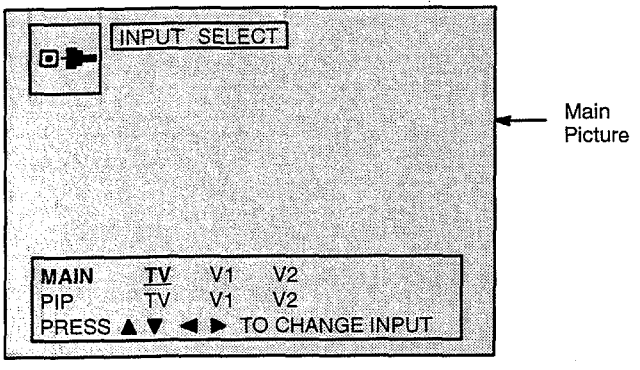
Located On Remote Control




## Main (Picture) Input Selection

This feature is used to select TV Mode Operation or one of two Video Inputs for the Main Picture. (Used with optional accessory Video equipment.)

1. Press the ACTION button to display the Main Menu.
2. Press the VOL RIGHT button to select the Input Icon.
3. Press the ACTION button to display the Input Select Menu.



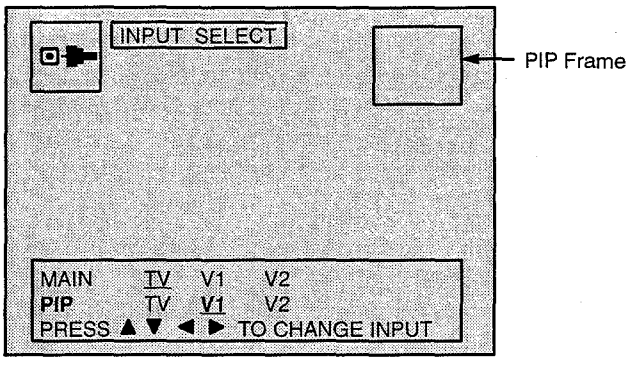

4. Press the CH UP or DOWN button to select "MAIN".
5. Press the VOL LEFT or RIGHT button to select TV or Video on 27" models (TV, V1(Video 1) or V2 (Video 2) on 31" models). The selected mode will be underlined.
6. Press the ACTION button twice to exit the Input Select Menu.

## PIP Input Selection

This feature is used to select TV Mode Operation or one of two Video Inputs for the PIP (Picture in Picture) frame. (Used with **second tuner** or optional accessory Video equipment.)

1. Press the ACTION button to display the Main Menu.
2. Press the VOL RIGHT button to select the Input Icon.
3. Press the ACTION button to display the Input Select Menu.
4. Press the CH UP or DOWN button to select "PIP" (the PIP frame will appear in the top right corner).
5. Press the VOL LEFT or RIGHT button to select TV or Video on 27" models (TV, V1(Video 1) or V2 (Video 2) on 31" models). The selected mode will be underlined.
6. Press the ACTION button twice to exit the Input Select Menu.

**NOTE:** The PIP frame will remain on screen, if desired press the PIP button to delete PIP frame.



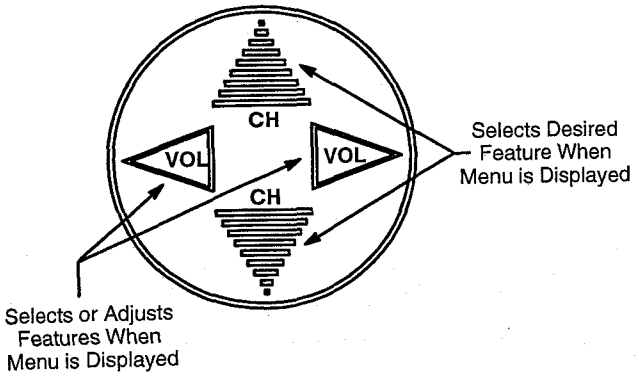

***Helpful Hints:***

The Game Guard feature must be deactivated before selecting Video Input for Main picture or PIP frame.

# Game Guard

Displays and Exits Menus

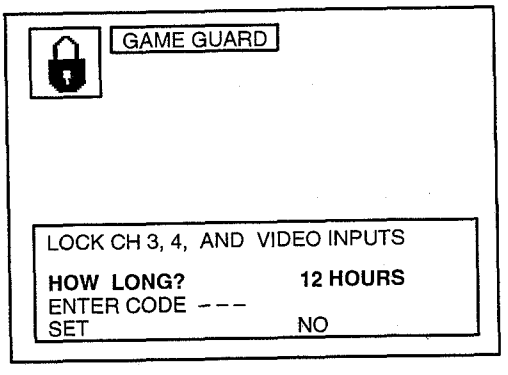
Located On Remote Control



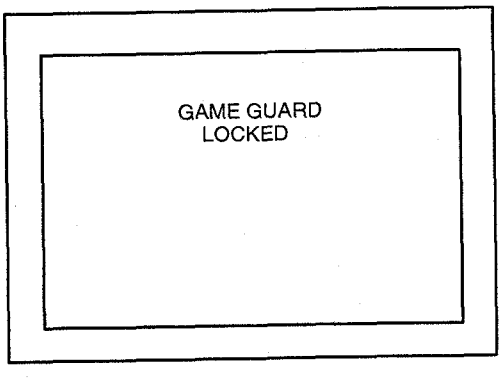

**Game Guard (Lockout)** – Prevents video games and other video sources from being viewed. Channel 3, 4 and all video inputs are locked out for 12, 24 or 48 hours.

**NOTE:** Be sure to understand this feature before attempting its use. **Use a code that you will easily remember.**

1. Press the ACTION button to display the Main Menu.
2. Press the CH DOWN button to select the Game Guard Icon.
3. Press the ACTION button to display the Game Guard Menu.




4. Press the VOL RIGHT button to select the desired hours (12, 24 or 48) for Game Guard (Lockout) to be activated.
5. Press the CH DOWN button to select "ENTER CODE". Then enter a 3 digit code with the Remote Control Keyboard.
   **Important Note: Use a code you can easily remember.**
6. Press the VOL LEFT or RIGHT button after entering three digit code. "Game Guard Locked" will display On Screen.




Game Guard Activated

## Game Guard (Unlock)

To unlock the Game Guard feature, repeat steps 1 through 3. Enter the same 3 digit code previously used in step 5 with Remote Control Keyboard.

**Serviceman Note:** When the code is forgotten press "ACTION" & "POWER" buttons simultaneously for more than 1.5 seconds to cancel feature.

# Disassembly for Service

## Back Cover

Remove all screws indicated by ◀ on back of set.

1. 5 screws (6 on some models) around perimeter of cabinet.
2. 1 screw (2 on some models) by A/V jacks.
3. 1 screw on AC line cord cover.
4. 1 screw on Flyback Transformer support.

## A–Board–Main Chassis

1. Push down on the securing plastic clips (in some sets) and slide chassis completely out. **NOTE:** Some tie–wraps securing wire dressings may have to be unfastened for chassis removal.
2. Stand chassis on it's edge. Now underside is completely accessible for component removal.

## C–Board–CRT Output

1. Plugs into socket on CRT neck.

## E–Board–Stereo/SAP Decoder

1. Is soldered into the main chassis (A–Board) at A21 and A22 connectors.

## Keyboard Push Button Assembly

1. The Keyboard push button assembly is fastened to the escutcheon with 1 screw.

## R–Board Remote Receiver

1. Secured to cabinet escutcheon by plastic clips. Use small screwdriver to gently lift clips and pull board out.

## S–Board – Second Tuner (PIP)

1. Mounted in cabinet next to to Y–Board.

## X–Board A/V 1&2, TV Switching, VAO AI Sound, Surround Sound, S–Video and Comb Filter

1. Plugs into main chassis A1, A2 and A3 sockets.
2. Release connector lock tabs and pull board upwards.
   **Note:** a small screwdriver or equivalent must be used to release the connector lock tabs.

## Y–Board – PIP Processing

1. The Y–Board plugs into the A–Board's A31 and A32 connectors.
2. Release connector lock tabs and pull board upwards.
   **Note:** a small screwdriver or equivalent must be used to release the connector lock tabs.

## Z–Board (31" Models only) –Pincushion Correction

1. Plugs into Main A–Board) A7 socket.

# Disassembly for CRT Replacement

## Disassembly

1. Discharge CRT as instructed in Safety Precautions.
2. Disconnect CRT 2nd anode button.
3. Remove C–Board from CRT base and unplug C10 (black wire–CRT dag ground) from board
4. Disconnect plugs A51, SP, DY & Degaussing coil from A– Board.
5. Slide main chassis assembly completely out with CRT Board attached.

## CRT Replacement

1. Perform DISASSEMBLY FOR CRT REPLACEMENT procedure.
2. Insure CRT H.V. anode button is discharged before handling CRT. See SAFETY PRECAUTIONS on handling the picture tube.
3. Remove components on CRT neck and place cabinet face down on a soft pad.
4. Note original locations and mounting of degaussing coil and dag ground assembly to insure proper reinstallation on the replacement CRT.
5. To remove degaussing coil:
   • Release degaussing coil from plastic clampers.
   • Remove the plastic clampers from each CRT mounting stud.
   • Retain plastic clampers for reuse on replacement CRT.
6. Remove the CY and DY from CRT neck.
7. Remove mounting hardware from each CRT mounting stud and remove CRT with dag ground braid attached.
8. To remove dag ground braid:
   • Unhook coil springs from lower CRT corner brackets. Release braid ends from upper left corner bracket (27" models only) and upper right corner bracket (31" models only).
9. Mount dag ground braid on replacement CRT.
10. Remove the AR coat protection sheet before mounting the replacement CRT in the cabinet.
11. Install replacement CRT into cabinet.
12. Install plastic clampers (step 5) on each CRT mounting stud and position degaussing coil as noted from original (step 4).

**NOTE:** Use tape to temporarily secure the degaussing coil to the CRT.

13. Replace components on CRT neck and reinstall chassis into cabinet. Make sure all ground wires and circuit board plugs are properly connected.
14. Ensure all wires are secure before reattaching the cabinet back.

# Purity and Convergence Procedure

Adjustment should be necessary only if the CRT or deflection yoke is replaced or if someone has disturbed the setting. The complete procedure consists of:

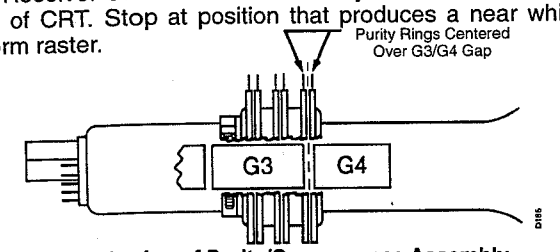
1. Initial static convergence
2. Setting purity
3. Final static convergence

## When CRT or Yoke is Replaced

Place the yoke on the CRT neck (do not tighten clamp).

Position purity/convergence assembly as shown and tighten clamp snugly. Cut hot–melt glue seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss CRT.

Turn Receiver ON and slide deflection yoke back and forth on neck of CRT. Stop at position that produces a near white, uniform raster.




**Positioning of Purity/Convergence Assembly**

## Initial Center Static Convergence

Connect dot/crosshatch generator to Receiver and tune in signal. Observe misconvergence at center of screen only.

Adjust 4 pole magnet (center rings): separate tabs and rotate device to converge blue with red.

Adjust 6 pole magnet (rear rings): separate tabs and rotate device to converge blue and red (magenta) with green.
**NOTE:** Precise convergence at this point is not important.

## Purity Adjustment

When in the Serviceman Mode for making electronic adjustments, Press the Remote Control (RECALL) button to enter Purity Check. (See Service Adjustments Electronic Controls.)

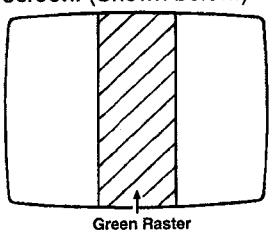
Operate the Receiver for 60 minutes using the first Purity check field (white screen) to stabilize the CRT.

Degauss the Receiver fully by using an external degaussing coil.

Press the Remote Control (RECALL) button again until the Purity Check (green screen) appears.

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the front rings to set the vertical green raster precisely at the center of the screen. (Shown below.)



**Green Raster**

Slowly move the deflection yoke forward and adjust for the best overall green screen.

Tighten the deflection yoke clamp screw.

Press the Remote Control (RECALL) button again until the Purity Check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.

Press the Remote Control (RECALL) button again until Purity check (white screen) appears. Observe the screen for uniform white. If not, repeat above procedure.

## Final Convergence Procedure

**NOTE:** Before attempting convergence adjustment, vertical size, pincushion and focus adjustments must be completed. Connect a dot pattern generator to the set. The brightness level should be no higher than necessary to obtain a clear pattern.

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

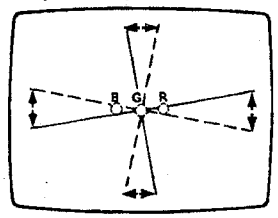
Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering pencil to reseal magnets.

Slightly tilt (do not rotate) the deflection yoke vertically and horizontally to obtain good overall convergence.

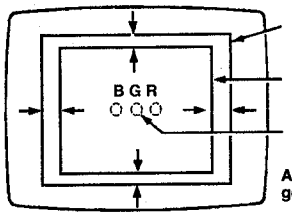
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.

Secure deflection yoke by inserting side two wedges at 3 and 7 o'clock positions.

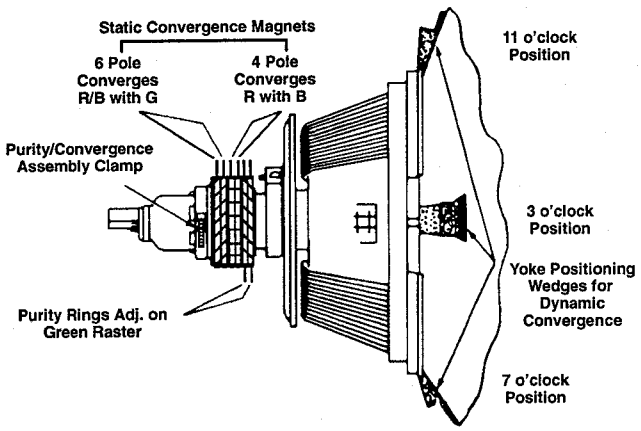
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over tab to secure to CRT.




**As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.**




**As the yoke is moved horizontally, one raster gets larger while the other gets smaller**




## Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ )

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.

# Service Notes

**IMPORTANT: To protect against possible damage to solid state devices due to arcing or static discharge, make certain all ground wires and CRT DAG wire are securely connected.**

**CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing to avoid damage to test equipment or chassis. Connect test equipment to correct ground ( ⏚ ) or ( ⏚ ) when servicing or incorrect readings will occur.**

**WARNING: This Receiver has been designed to meet or exceed applicable safety and X-radiation protection as specified by government agencies and independent testing laboratories.**

**To maintain original product safety design standards relative to X-radiation and shock and fire hazard, the parts indicated by the symbol ⚠ on the schematic must be replaced with identical replacement parts. Order parts from the manufacturer's parts center using numbers shown in this service manual or give complete chassis number and part reference number.**

**For optimum performance and reliability, all other parts should be replaced with components having identical specifications.**

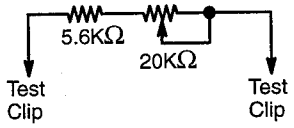
## Horiz Hold Down Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If for any reason the high voltage and beam current exceed a predetermined amount, this circuit operates and detunes the horizontal oscillator. As a result, the horizontal looses sync and if high voltage or beam current varies significantly the video is interrupted to blank the screen. This limits high voltage.

The Horizontal Hold Down protection circuit is not adjustable. However, if components indicated by the symbol ⚠ on the schematic in either the horizontal sweep system or the Hold Down protection circuit itself are changed the operation of the circuit should be checked using the following procedure.

Equipment needed:

1. Signal Generator with crosshatch pattern.
2. Digital Voltage Meter
3. High Voltage Meter (0V–50KV)
4. Variac and Isolation Transformer
5. HHS test jig made with 20KΩ potentiometer and 5.6KΩ resistor with test clips as shown.



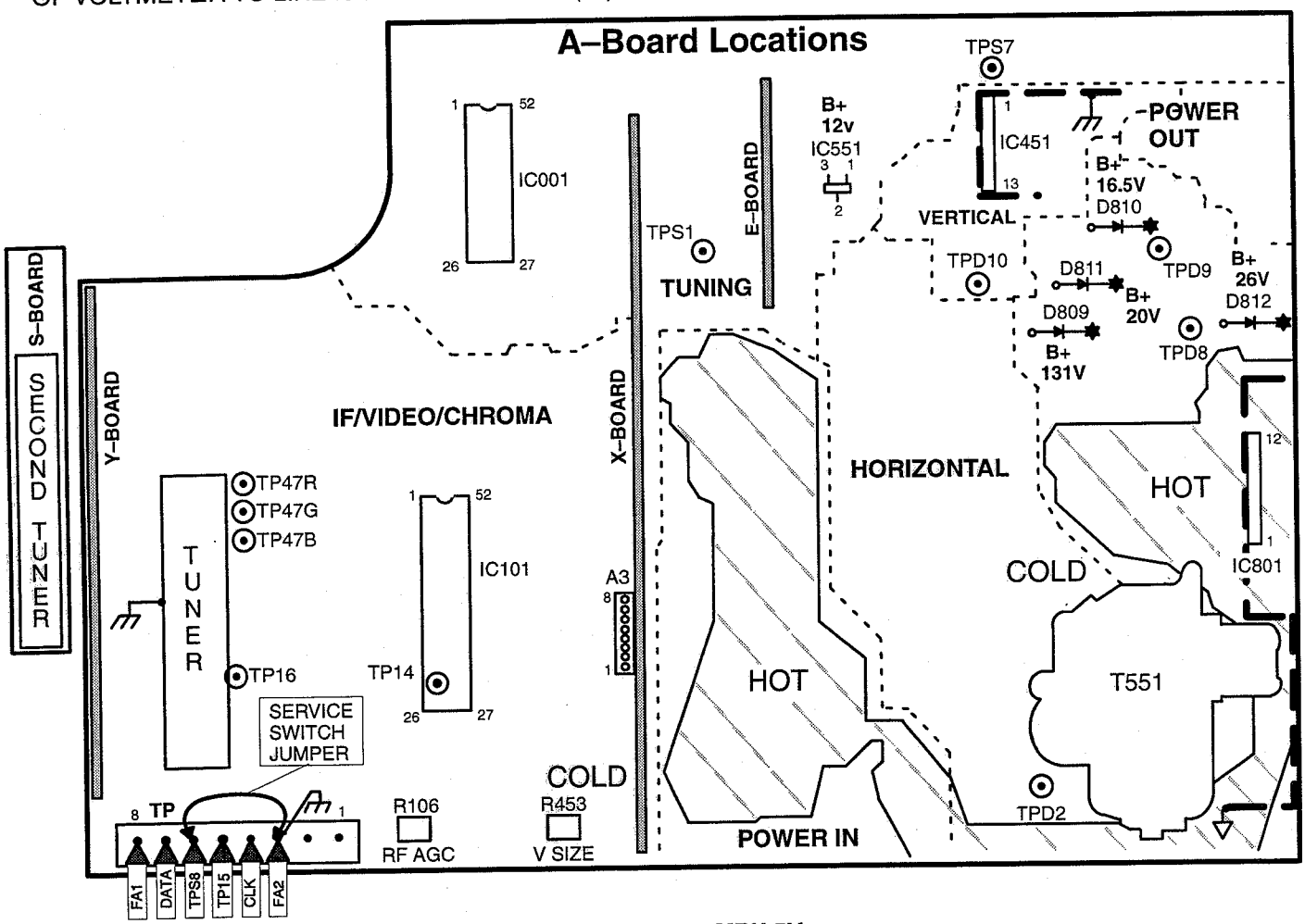

**Preparation**

1. Connect Receiver through variac and isolation transformer to AC line. Set variac to 120V AC.
2. Connect signal generator with crosshatch pattern.
3. Connect High Voltage Meter to 2nd anode under rubber cup on CRT.
4. Turn Receiver ON and confirm that horizontal is in sync.
5. Use the Picture Icon Menu to adjust Brightness and Picture video adjustments for a DVM reading between 0.5V and 1V. (This condition exists when the crosshatch pattern is just viewable on the screen.)
6. Turn Receiver OFF. Connect the HHS test jig to IC801 Pin 1 and Pin 2. Test jig potentiometer should be set to maximum resistance.
7. Turn Receiver ON. Slowly reduce the potentiometer resistance until the horizontal just begins to pull out of sync.
8. Observe the High Voltage meter. HIGH VOLTAGE should read less then 34.8KV at point where horizontal sync is lost.
9. Turn Receiver OFF. Disconnect test jig and meter leads from chassis.

**CAUTION:**
If High Voltage is not within the specified limit, the cause must be determined before the Receiver is returned to the owner.

# Service Adjustment Procedures

**ALL SERVICE ADJUSTMENTS ARE FACTORY PRESET AND SHOULD NOT REQUIRE ADJUSTMENT UNLESS CONTROL AND/OR ASSOCIATED COMPONENTS ARE REPLACED.**
**NOTE:** CONNECT MINUS LEAD OF VOLTMETER TO CORRECT GROUND FOR CIRCUIT BEING CHECKED. WHEN NECESSARY TO USE A LINE OPERATED GROUND, THE GROUND INDICATION (⏚) WILL BE INDICATED. FOR THIS GROUND, USE IC801 HEAT SINK. FOR ALL OTHER CIRCUITS, CONNECT MINUS LEAD OF VOLTMETER TO LINE ISOLATED GROUND (⏚)TUNER SHIELD, IC451 HEAT SINK OR FA2.




## 131.0V B+ Voltage Confirmation

1. Set BRIGHT and PICTURE by using Picture Menu to Minimum.
2. Connect a DVM between cathode of D809 and cold ground (⏚) FA2 (TP Pin3).
3. Confirm that B+ voltage is 131.0V ±1.0V. This voltage supplies B+ to Horizontal Output & Flyback circuits.

## Source Voltage Chart

120V AC line input. BRIGHT and PICTURE of Picture Menu adjusted to Minimum. Use cold ground (⏚) for minus lead of DVM.

| | |
|---|---|
| Pin 3 of IC551 | +9.0V ±0.5V |
| Cathode of D810(TPD9) | +16.5V ±2.0V |
| Cathode of D811(TPD10) | +20.0V ±2.0V |
| Cathode of D812(TPD8) | +26.0V ±2.0V |
| Cathode of D554 | +220V ±15V |

Adjust Picture menu for normalized video adjustments.

## B+ 5V Source Voltages

**Volatile 5V:**
Cathode D557 = Tuner BP, IC101 (B+ $V_{cc}$), RF AGC (R106)

**MPU 5V:**
Emitter Q002 = IC001($V_{DD}$)

**Standby 5V:**
Cathode D006 = Keyboard, IC001 (Key in 1, $I^2C$ EE-PROM (IC002), Remote Receiver (some models)

## B+ 9V Source Voltage

Cathode D560 = IC101 (B+ $V_{cc}$) (HOLD DOWN) (AFC OUT),Q306 – Q305 (Video), Q307 (Closed Caption E.F.), IC001 (Audio Control B/T/B in some models).

## B+ 12V (Stand–by)

Cathode D001 = RL001 (on–off relay), Q002 (+5V Reg), IC101 (Horiz. Vcc).

## High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears
3. Confirm B+ 131V is within limit.
4. Using a calibrated high voltage meter confirm that High Voltage is 29.25kV ±1.25kV.

# Serviceman Mode (Electronic Controls)

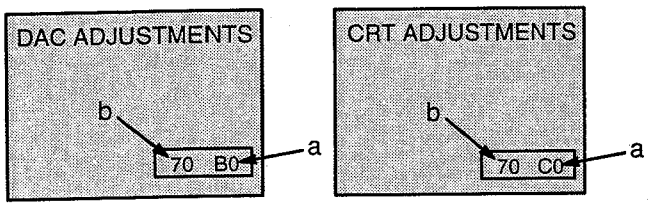
This chassis has new electronic technology using the $I^2C$ Bus Concept. The system usually performs as a control function and replaces many of the required mechanical controls. Instead of adjusting various mechanical controls individually, many of the control functions are now performed electronically by using "On Screen Menu". (The Serviceman Adjustment Mode.)

**NOTE:** It is suggested that a serviceman read all the way through and understand the following procedure for Entering/Exiting the Serviceman Adjustment Mode; then proceed to follow the instructions working with the Receiver. After a person is familiar with this adjustment procedure, use the Instructional Flow Chart for Serviceman Mode as a quick guide.

## Entering Serviceman Mode:

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA1 (TP pin 8) to cold ground ( ⏚ ) FA2 (TP pin 3).
   ***"The Receiver enters the Aging Mode".***
   (The VOLUME UP/DOWN will adjust rapidly.)
2. **Press** ACTION button and VOLUME UP button on Receiver Control Panel simultaneously.
   ***"The Receiver enters the Servicemans Mode".***
   (The VOLUME UP/DOWN will adjust normally.)
   (All customer controls are set to a nominal level.)
3. **Press** the POWER button on the Remote Control to select one of four Serviceman Adjustment Modes.
   - B = Serviceman DAC ADJUSTMENTS
   - C = Serviceman CRT ADJUSTMENTS
   - S = Factory Adjustments for PIP
   - Normal TV = Normal operation of channel ▲▼ and volume ▲▼

   **Note:** Sb is used for MPU clock–offset

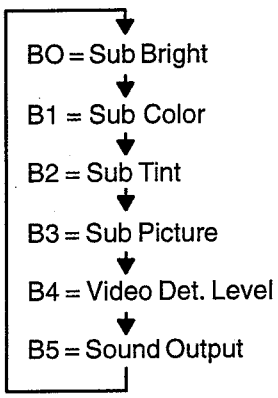



An Address Menu appears in the bottom right hand corner of the screen.

## For DAC Adjustments:

**a.) Press**
CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustment Addresses.

**Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.**




**b.) Press**
VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

**Adjustment Range and Default level values for Service Adj.**

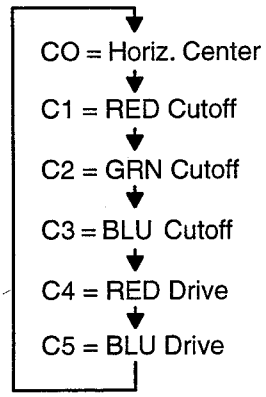
| Service Adjustment | Adj Range | Default Level |
|---|---|---|
| Sub Bright (BO) | 0 ~ 127 | 97 |
| Sub Color (B1) | 0 ~ 63 | 33 |
| Sub Tint (B2) | 0 ~ 63 | 33 |
| Sub Picture (B3) | 0 ~ 63 | 21 |
| Video Detector Level (B4) | 0 ~ 15 | 8 |
| Sound Out (B5) | 0 ~ 15 | 8 |

Press the POWER button on the Remote Control to select Serviceman CRT Adjustment Mode.

## For CRT Adjustments:

**a.) Press**
CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustments.

**Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.**




**b.) Press**
VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

**Adjustment Range and Default level values for Service Adj.**

| CRT Adjustment | Adj Range | Default Level |
|---|---|---|
| Horiz Centering (C0) | 0 ~ 15 | 8 |
| RED Cutoff (C1) | *0 ~ 511 | 128 |
| GRN Cutoff (C2) | *0 ~ 511 | 128 |
| BLU Cutoff (C3) | *0 ~ 511 | 128 |
| RED Drive (C4) | 0 ~ 255 | 128 |
| BLU Drive (C5) | 0 ~ 255 | 128 |

*Adjustment indicated in 2 steps (0 ~ 255) ➡ (H0 ~ H255)

**(cont'd.)**

Press the Power button on the Remote Control to select the next Serviceman Mode.

## Factory Adjustments: S0~Sb

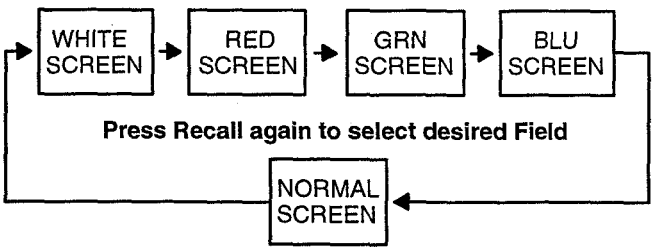
The Factory Adjustments for PIP can be entered but no adjustments should be necessary. These are factory set for normal PIP performance. Write the original value for each address in case one of these adjustments is changed by mistake. Confirm that the values are as shown for default level.

**Adjustment Range and Default level values for Service Adj.**

| Service Adjustment | Default Level |
|---|---|
| PIP Color (S0) | 25 |
| PIP Tint (S1) | 55 |
| PIP Sync Level (S2) | 04 |
| PIP Upper V–Pos (S3) | 229 |
| PIP Lower V–Pos (S4) | 111 |
| PIP Left H–Pos (S5) | 30 |
| PIP Right H–Pos (S6) | 126 |
| Small PIP Upper V–Pos (S7) | 229 |
| Small PIP Lower V–Pos (S8) | 93 |
| Small PIP Left H–Pos (S9) | 30 |
| Small PIP Right H–Pos (Sa) | 140 |
| MPU Clock–offset (Sb) | 128 |

## To Check Purity:

Press the RECALL button on the Remote Control to enter Purity Field Check Mode.
**NOTE:** Must be in Serviceman Mode to get color.




**IMPORTANT NOTE:**
**Always Exit Serviceman Mode After Use.**

## Exit Serviceman Mode:

1. Press ACTION + POWER buttons on receiver simultaneously for approximately 2 seconds.
   ***"The Receiver exits Serviceman Mode".***

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

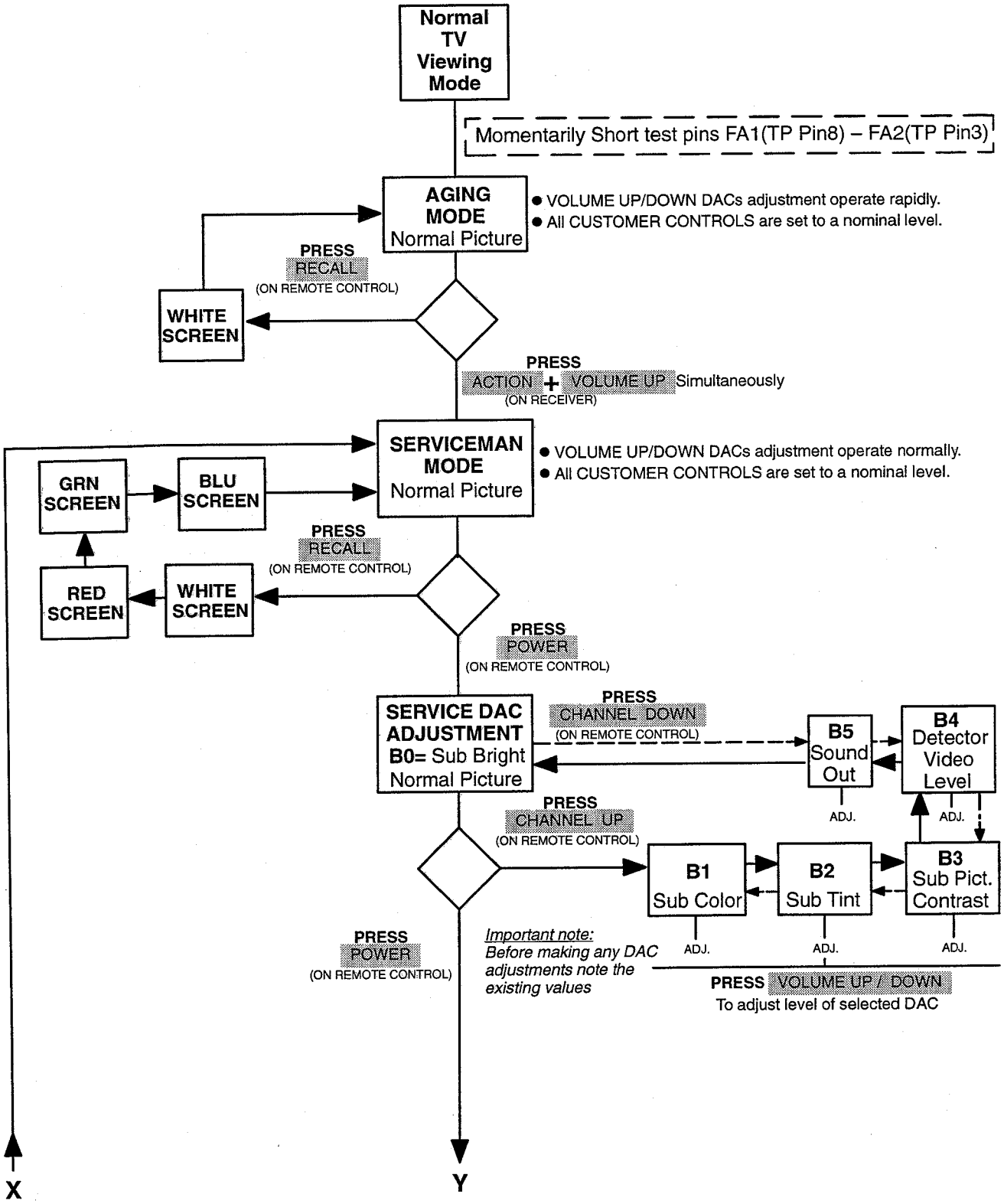
## Quick Entry To Serviceman Mode

At times when minor adjustments need to be done to the electronic controls, the method of Entering the Serviceman Mode without removal of the cabinet back is as follows using the Remote Control:

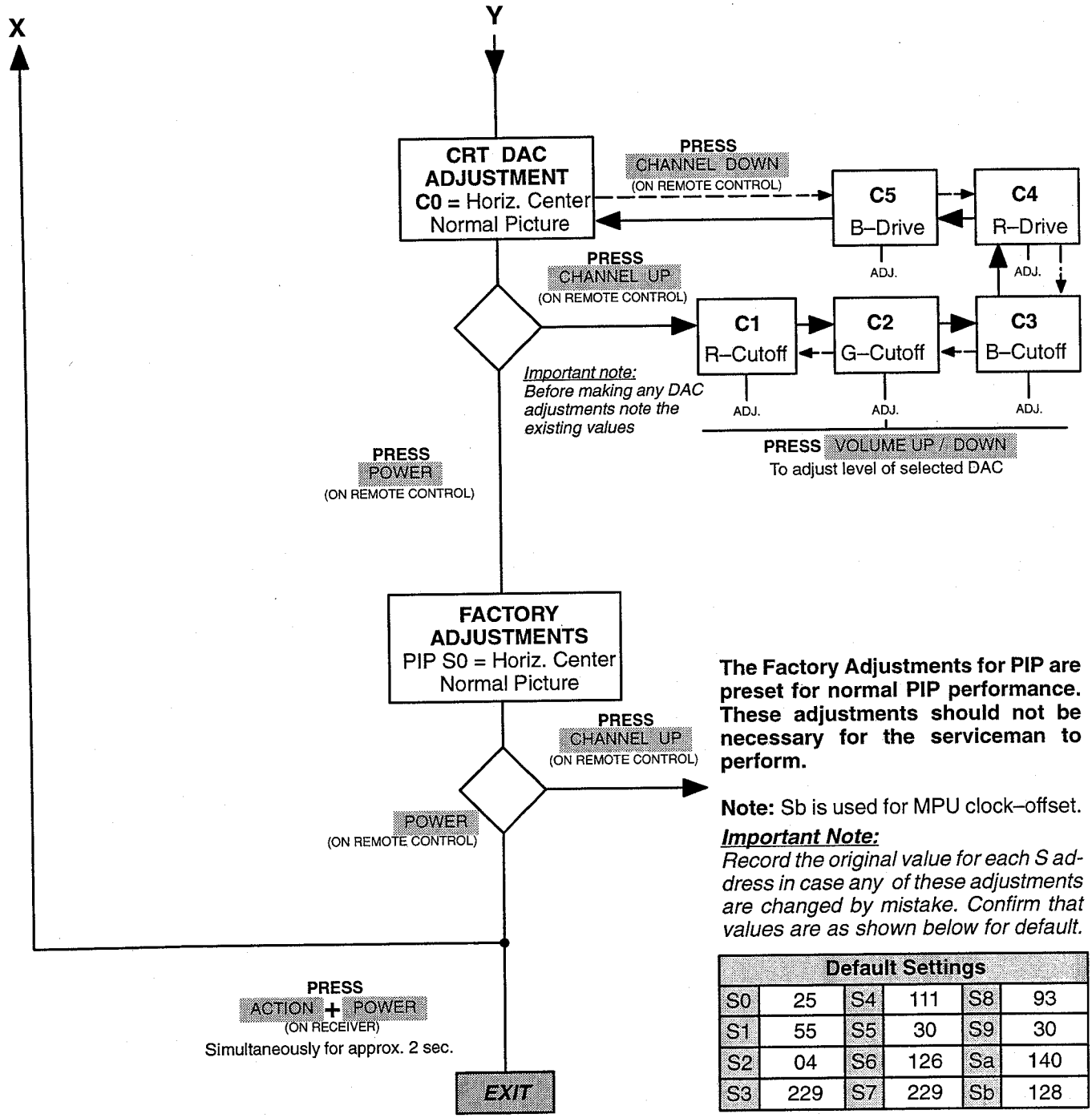
1. Select SET–UP icon and select CABLE mode.
2. Select TIME Icon and set SLEEP timer for 30.
3. Press ACTION button twice to cancel Icon Menus.
   Tune to Channel 124.
   Adjust VOLUME to Minimum (0).
   **On Receiver** press the VOL ◄ button (decrease).
   Red "CHK" appears in upper corner.

# Instructional Flow Chart for Serviceman Mode

***Caution: Always EXIT Serviceman Mode after use***




**(cont'd.)**




**The Factory Adjustments for PIP are preset for normal PIP performance. These adjustments should not be necessary for the serviceman to perform.**

**Note:** Sb is used for MPU clock–offset.

***Important Note:***
*Record the original value for each S address in case any of these adjustments are changed by mistake. Confirm that values are as shown below for default.*

| Default Settings | | | | | |
|---|---|---|---|---|---|
| S0 | 25 | S4 | 111 | S8 | 93 |
| S1 | 55 | S5 | 30 | S9 | 30 |
| S2 | 04 | S6 | 126 | Sa | 140 |
| S3 | 229 | S7 | 229 | Sb | 128 |

Receiver shuts OFF; then turns ON, TUNED TO CHANNEL 3 WITH A PRESET LEVEL OF SOUND.

**Note:** This will also erase any Programmed Channels, Channels Caption data and some other user defined items.

# Service Adjustments (Electronic Controls)

## Sub–Brightness

**Serviceman DAC Adjustment (B0)**

Adjustment of this control is important for getting proper operation of customer brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after Sub–Brightness is set.

**Preparation:**

1. Connect a color bar signal with 100 IRE white and 7.5 IRE black. (Switch Color "OFF" on the generator.) Operate television for a minimum of 10 minutes prior to the adjustment.

**Procedure:**

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B0) and adjust so the black bar starts to look grey. Then decrease the adjustment to the point where grey turns to black.

## Video Detector Level

**Serviceman DAC Adjustment (B4)**

**Preparation:**

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect oscilloscope to TP12. Use cold ground for scope connection. Set scope at Horizontal rate (20μs) time base.

**Procedure:**

1. In Serviceman Mode for making electronic adjustments, select DAC Adjustment (B4) and adjust for 1V from sync tip to white level. See detail.

2. Set SUB–CONTRAST adjustment (DAC adjustment B3).

## Sub Contrast

**Serviceman DAC Adjustment (B3)**

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or the CRT is replaced.

**Preparation:**

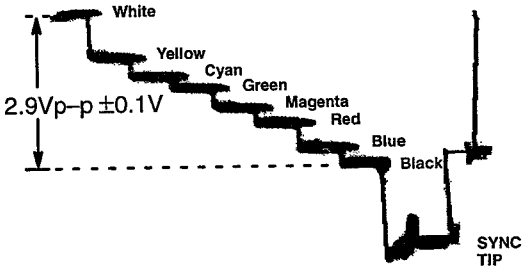
1. Connect a generator pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

**NOTE:** The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to your pattern used.

2. Connect oscilloscope to CRT–Board connector C1–2 (TP35) Set scope horizontal time base to 20μs (horizontal).
3. Connect a jumper from TPD2 to ground (⏚).

**Procedure:**

1. In the Serviceman Mode for electronic adjustments, select DAC Adjustment (B3) and adjust for 2.9Vp–p ±0.1V from white level to black level on video waveform (see video waveforms detail).




2. Remove jumper (Preparation step 3).

## Tint/Color Adjustment

**Serviceman DAC Adjustment (B2) (B1)**

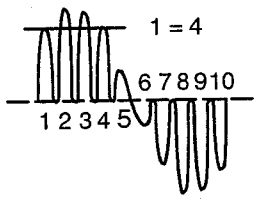
**Preparation:**

1. Connect a rainbow color bar signal.
2. Connect oscilloscope to TP47R (A–Board) or connector C1 pin 1 (CRT–Board).
3. Connect jumper from TPD2 to GND (⏚).

**Procedure:**

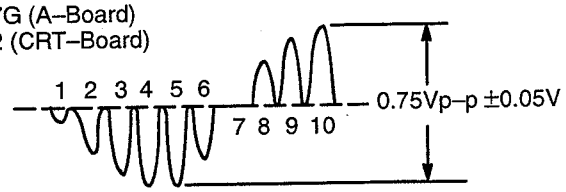
1. In serviceman Mode for making electronic adjustments, select DAC Adjustment (B2) and adjust waveform so peak 1 is the same as peak 4 as shown in the detail.

TP47R (A–Board)
C1–1 (CRT–Board)




2. Connect oscilloscope to TP47G (A–Board) or connector C1 pin 2, TP35 (CRT–Board).
3. Select DAC adjustment (B1) and adjust for peak to peak waveform to be 0.75V p–p ±0.05V.

TP47G (A–Board)
C1–2 (CRT–Board)




4. Remove jumpers (Preparation step 3).

## Color Temperature Adjustment (B/W Tracking)

**Serviceman DAC Adjust. (C1) (C2) (C3) (C4) (C5)**

## Minor Touch–Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

- LOW LIGHT areas – In Serviceman Mode for making electronic adjustments, select cutoff (C1) RED, (C2) GRN, (C3) BLU and adjust picture for grey.
- HIGH LIGHT areas – In Serviceman Mode for making electronic adjustments, select Drive (C4) RED, (C5) BLU and adjust for warm whites.

## Complete Adjustment

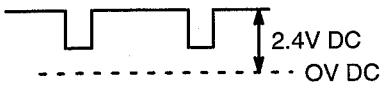
**Preparation:**

1. Turn Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply color bar signal with color "OFF".
3. Turn SCREEN control (part of FBT T551) fully counterclockwise.

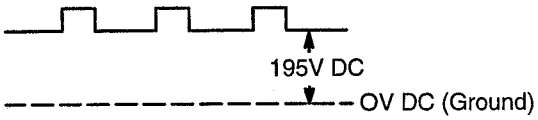
**Procedure:**

Preset Serviceman DAC's C1, C2 and C3 levels to 128 for best results.

1. Connect oscilloscope to TP35 (CRT–Board).
2. In Serviceman Mode for making electronic adjustment, select Sub Bright (B0).
3. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
4. Observe oscilloscope waveform at Horizontal rate and adjust Serviceman Mode Sub Bright DAC (B0) for scanning period of 2.4V above DC ground shown in detail.




5. Remove jumper. (Step 3)
6. Connect scope to GRN Cathode (KG) on CRT–Board.
7. In Serviceman Mode for making electronic adjustments, select GREEN CUTOFF DAC (C2).
8. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
9. View scope trace at Horizontal rate and adjust Serviceman Mode DAC (C2) for the scanning period to be 195V above DC ground. (See detail)
10. Remove jumper. (Step 8)
11. Connect scope to RED Cathode (KR) located on CRT board.
12. In Serviceman Mode for making electronic adjustments, select RED CUTOFF DAC (C1), connector TP pin 6 to pin 3).
13. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
14. View scope trace and adjust Serviceman Mode DAC (C1) for the scanning period to be 195V above DC ground. (See detail)
15. Remove jumper. (Step 13)
16. Connect scope to BLU Cathode (KB) located on CRT board.
17. In Serviceman Mode for making electronic adjustments, select BLU CUTOFF (C3).
18. Connect jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
19. View scope trace and adjust Serviceman Mode DAC (C3) for the scanning period to be 195V above DC ground. (See detail)




**Adjustment Waveform Detail (Steps 9, 14, 19)**

20. Turn Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
21. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C1) RED, (C2) GRN, (C3) BLU; increase their colors to create a white horizontal line.
22. Remove jumper. (Step 18)
23. Confirm good gray scale by viewing B/W color bar pattern.
24 In Serviceman Mode for making electronic adjustments select DAC DRIVE adjustments (C4) RED, (C5) BLU and adjust for warm white in white color bar of pattern.
25. EXIT Serviceman MODE.
26. Adjust Picture Menu Video Adjustments BRIGHT and PICTURE from low scale to high scale and check Black and White tracking.
27. If correction needed: Re–Enter Serviceman Mode and perform **Minor Touch – Up Method.**
28. Perform SUB BRIGHTNESS adjustment procedure.

## Horizontal Centering

**Serviceman DAC Adjustment (C0)**

**Preparation:**

1. Connect crosshatch generator.

**Procedure:**

1. In Serviceman Mode for making electronic adjustments. Select DAC adjustment (C0) and adjust so center of crosshatch pattern is centered on CRT screen.
2. EXIT Serviceman Adjustment Mode.

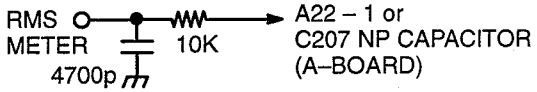
## Sound Out

**Serviceman DAC Adjustment (B5)**

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

**Preparation:**

1. Connect 400Hz. 100% modulation (25KHz deviation) signal generator to antenna (70db ±5db, 75Ω open P/S 10db). Generator pre–emphasis must be "OFF" for 1KHz.
2. Connect RMS Meter with filter jig as shown in detail.




**Procedure:**

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B5) and adjust for RMS meter reading of 150mV rms ±7.5mV rms.
2. EXIT Serviceman Adjustment Mode.

## MPU Reference Oscillator (Sb)

### Preparation:

1. Connect frequency counter from TPS1 (IC001 Pin 25) to cold ground ( ⏚ ).

**NOTE:** Frequency Counter probe capacitance should be 8PF or less.

### Procedure:

1. Turn Receiver "OFF" with AC power applied.
2. Measure TPS1 (IC001 pin 25) for the period of the waveform (record reading).
3. Turn Receiver back "ON".
4. Place Receiver into serviceman Mode for making electronic adjustment, select DAC Adjustment (Sb).
5. Set (Sb) based on following formula:

$$Sb = 1350128 - \frac{7372800000}{\text{pin 25}}$$

**NOTE:** After the proper number is loaded into Sb, pin 25 measurement will remain the same as previously measured.

**Sample chart for loading Sb (register range is 0 thru 255).**

| Sb register | pin 25 reading |
|---|---|
| 0 | 5460.816 |
| 1 | 5460.820 |
| 2 | 5460.824 |
| 127 | 5461.329 |
| 128 | 5461.333 |
| 129 | 5461.337 |
| 253 | 5461.839 |
| 254 | 5461.843 |
| 255 | 5461.847 |

**NOTE:** If TPS1 (IC001 pin 25) is measured in Hz unit with the Frequency Counter use following formula:
Sb = 13501028 – [7372.8 x pin 25 (Hz)]
Must have at least four digits of resolution behind decimal point for pin 25 reading.
Sample: 000.0000

# Service Adjustments (Mechanical Controls)

## RF AGC Delay R106

Adjust only if overloading on strong signal or busy background (snow) is present on moderate strength signals.

1. Adjust RF AGC control R106 until snow appears in picture, then adjust control until snow is eliminated.
2. Check all channels for optimum setting.

## AFC Field Adjustment L103

1. Select TV signal mode with Menu.
2. Defeat AFC by applying jumper from TPS7 to ground (⏚).
3. Connect a digital voltmeter to AFC test point TP16.
4. Use Remote Control to Check all active High Band channels 7~13 for AFC voltage range. Select channel with AFC voltage in approximate center of voltage range.
5. Adjust L103 for 4.6V ±0.1V at TP16.
6. Check all active channels for proper AFC correction. Touch up L103 if required. Remove jumper in step 2.

**NOTE:** Do not use TV/CABLE channel with offset carriers for adjustment or in determination of low and high range of AFC voltage.

## Sound Alignment L201

1. Select active TV channel.
2. Attenuate signal (loosely couple antenna lead or use RF attenuator pad) for noisy sound.
   - Adjust L201 for maximum sound. Signal to noise ratio is best when L201 is peaked.
3. Connect antenna or remove RF attenuator for strong signal.

## Comb Filter Adjustment (31" Models only) – R3215 and L3202 (X–Board)

1. Connect an NTSC color bar generator (not rainbow generator) to video Input.
2. Normalize Picture Menu Video Adjustments. Then adjust SHARPNESS to Max. and COLOR to Min.
3. Connect an oscilloscope to any of the following: Connector A3 pin 5 (A–Board), TP47G (A–Board), or TP35 (CRT–Board).
4. Set oscilloscope sweep rate to view color burst signal on horizontal sync pulse.
5. Set BALANCE control R3215 fully clockwise. Burst amplitude should increase making it more visible.
6. Adjust phase coil L3202 for Minimum burst amplitude.
7. Re–adjust BALANCE control R3215 for Minimum burst amplitude.
8. Repeat procedure steps 6 & 7.

## Vertical Size R453

1. Turn VERTICAL SIZE control R453 CCW until top and bottom edges of raster are visible.
2. Adjust VERTICAL SIZE control CW until top and bottom of raster touch bezel edge. Advance SIZE control CW an additional 30 degrees. This will be approximately 10% overscan. Linearity adjustment is automatic with size adjustment.

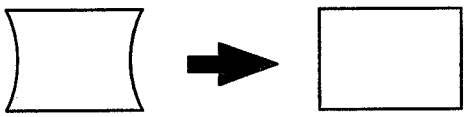
## Pincushion Correct (R761) & Horizontal Width (R760) Z–Board (31" Models only)

**Preparation**

1. Connect crosshatch pattern generator.
2. Normalize the PICTURE Menu Video Adjustments.
3. Adjust Horizontal Width (R760) to MID position.

**Procedure**

1. Adjust Pincushion Correct Control (R761) for the straightest left and right vertical lines.



2. If needed, adjust Horizontal Width (R760). Adjust for equal horizontal size of right side and left side boxes.

## Focus (Part of T551)

**Preparation**

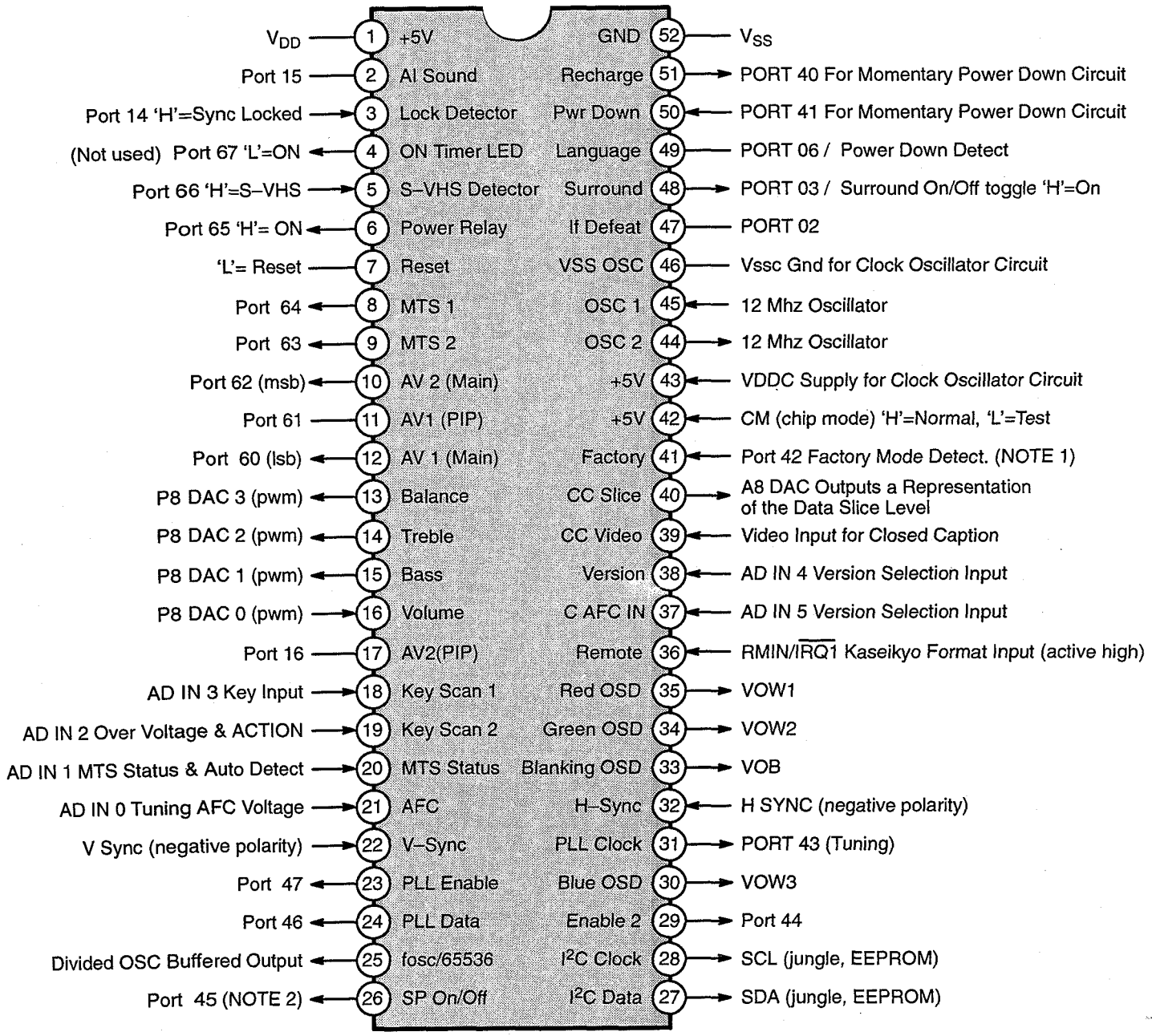
1. Connect Signal generator and select dot pattern.

**Procedure**

1. Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.
   (a) adjust for best center
   (b) adjust for best area between center and top right corner.

# New Circuits

## IC001 MPU IN/OUT Pins and Functions

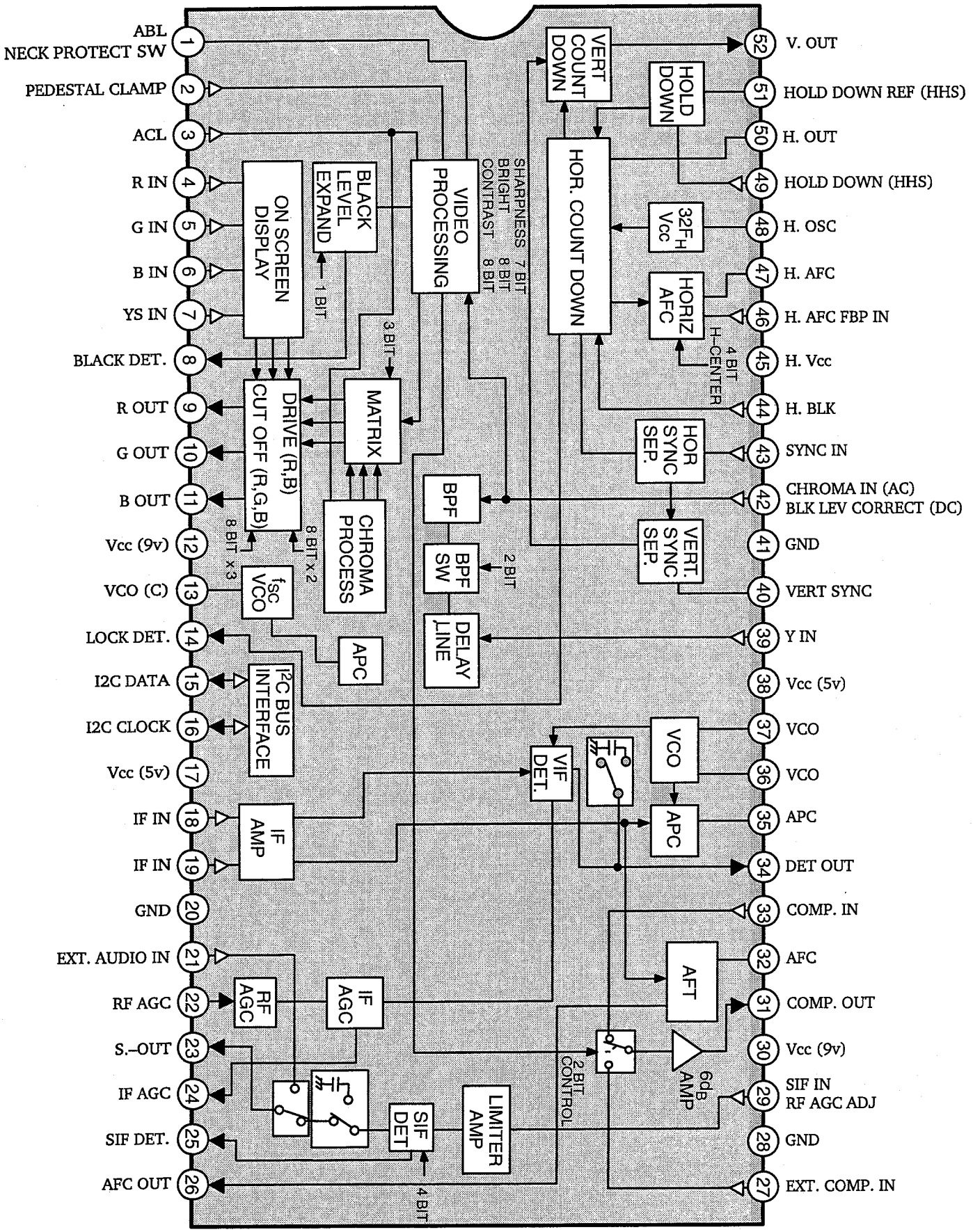



**NOTE 1:**
Momentarily pulling pin 41 to ground and releasing it will put the microprocessor into factory aging mode. Holding this line at ground will inhibit microprocessor access to $I^2C$ bus line.

**NOTE 2:**
Speaker On/Off is also used as audio defeat line.

# IC101 Block Diagram

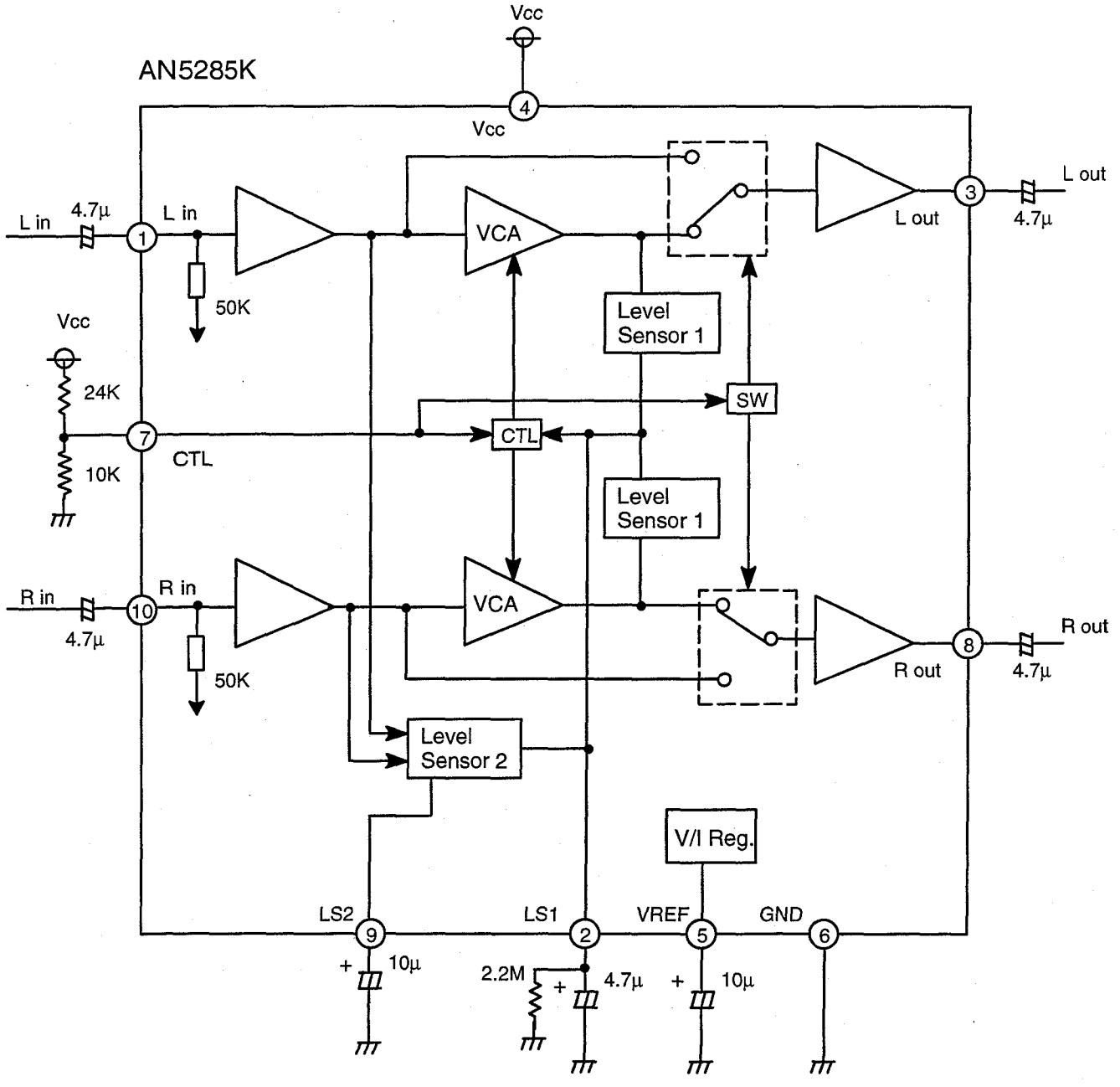
INPUT PINS = ▽ △ OUTPUT PINS = ▲ ▼



# *AIS (Artificial Intelligence Sound)

This receiver uses Artificial Intelligence (AI) Sound to modulate abrupt changes in sound volume level. It is primarily designed to prevent sudden loud changes in sound volume, such as those which occur when a television program is interrupted by a commercial. It also equalizes the maximum volume level when switching between different channels or when switching between broadcast and other A/V sources.

The AIS circuit is incorporated into the system through the use of an Automatic Gain Circuit, IC2451, which is located on the X–Board. AIS activation is MPU controled through the IC's switch terminal at pin 7. Right and left channel sound enters the circuit at pins 1 and 10 respectively, where they are sampled, then either amplified or dampened according to preset levels. The "streamlined" sound is then outputed through pins 3 and 8 (left and right channels respectively).

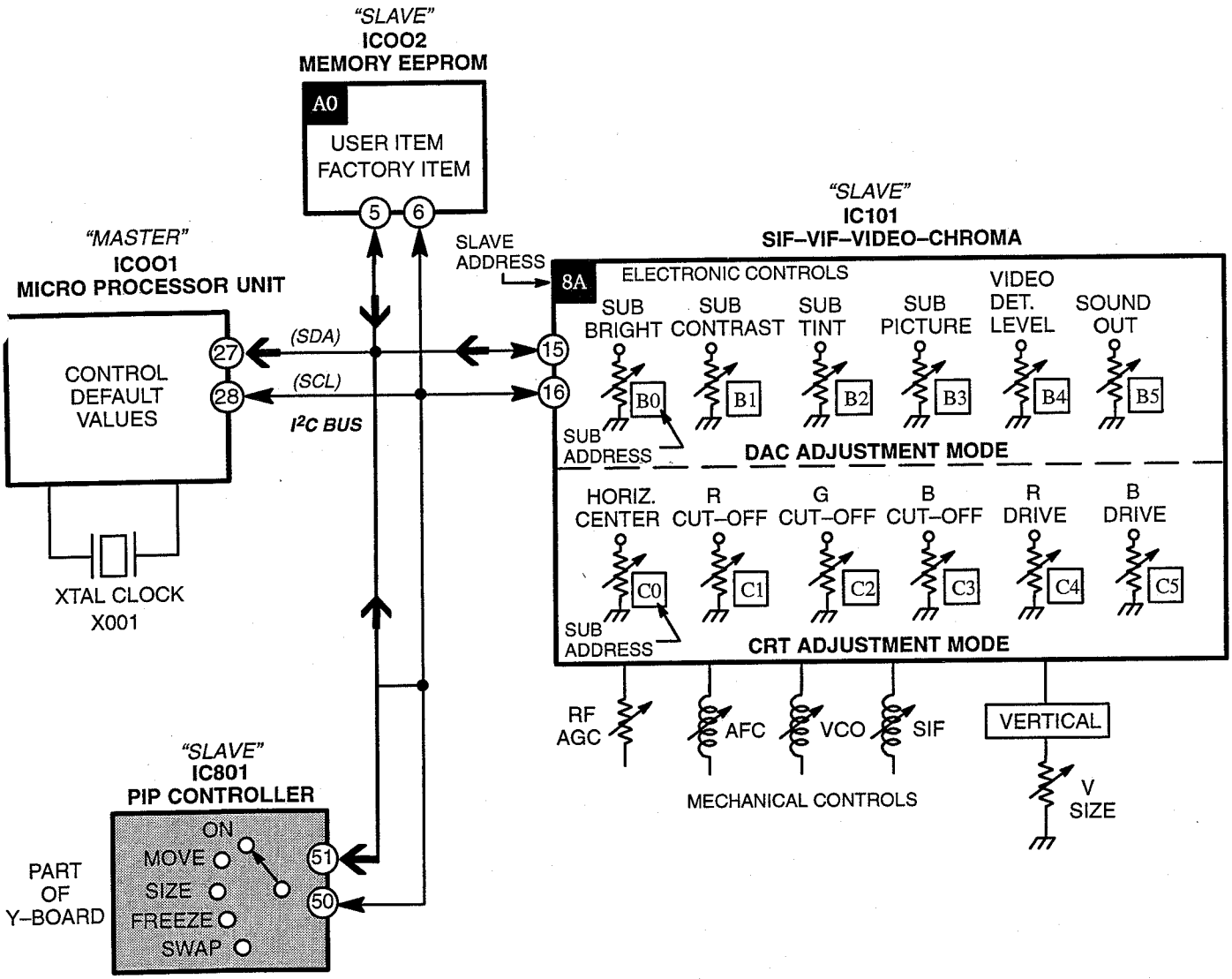


# I²C Bus Line System

This Receiver makes use of one of the latest electronic technologies by using an I²C (Inter–Integrated Circuit) Bus Line Concept. Two wires, SDA (Serial Data) and SCL (Serial Clock) carry information between devices connected to the Bus. Each device connected to the Bus has a unique address for receiving data information (a Receiver) from a source (the Transmitter).

The devices are also considered to be a "Master" or a "Slave" when data is transmitted or received. In this Receiver, the "Master" (Micro Processor Unit,IC001) is the device which initiates a data transfer in the Bus line and generates the clock signal required to permit the data to be sent. The "Slaves" (MEMORY I²C EEPROM, IC002, VIF–SIF–VIDEO–CHROMA JUNGLE, IC101 and PIP Controller, IC1801) are the devices addressed by the MPU and receive the data transmitted.

This system usually performs as a control function and replaces many of the required mechanical controls needed in a television receiver. Instead of adjusting various mechanical controls individually, many of the control functions can be performed electronically using "On Screen Menus", (The Serviceman Mode).



# Switching Power Supply

B+ source voltages are produced at the secondary of T801 by high frequency switching of a MOSFET transistor inside IC801. Also included in the STK730–020 package is an Amplifier, Error Detector and Over Current Protection circuit. Altogether, these circuits produce a semi regulated off line power supply circuit which require few external parts.

**Operation**

The switching action is done in the following way:

Starter voltage from the bridge rectifier is applied to IC801 pin 4 (the Gate of MOSFET,TR1) through resistors R814 and R808. TR1 turns ON and Drain current starts to flow through the primary winding (NP) of T801. At the same time a voltage is induced at the ND1 winding which keeps a voltage on the Gate and TR1 stays ON. Drain current continues to flow and increases the voltage across the current detecting resistor R805 (IC801 pin 8). This induced voltage is integrated by the R/C time constant of IC801 internal resistor R3 and external capacitor C828 (pin 7). The voltage is applied to the Base of IC801 internal transistor TR3.

**Regulation**

The primary winding of T801 (NP) and the secondary windings (NS) are wired with opposite polarity. When TR1 is conducting. The current flows through winding NP. The secondary windings (NS) have no current because the B+ rectifier diodes block the flow.

The current flowing through TR1 and NP winding increases at a linear rate. When the voltage between Pins 1 and 3 of IC801 reach a fixed voltage of approximately 40.5V, TR1 turns OFF by the operation of IC801 internal error amp. This provides a state of regulation.

The secondary windings NS are wired so their voltages are in proportion to the voltage across the ND2 winding. Therefore output voltage is controlled by the error amp monitoring the voltage across ND2 winding and controls the conduction of TR1.

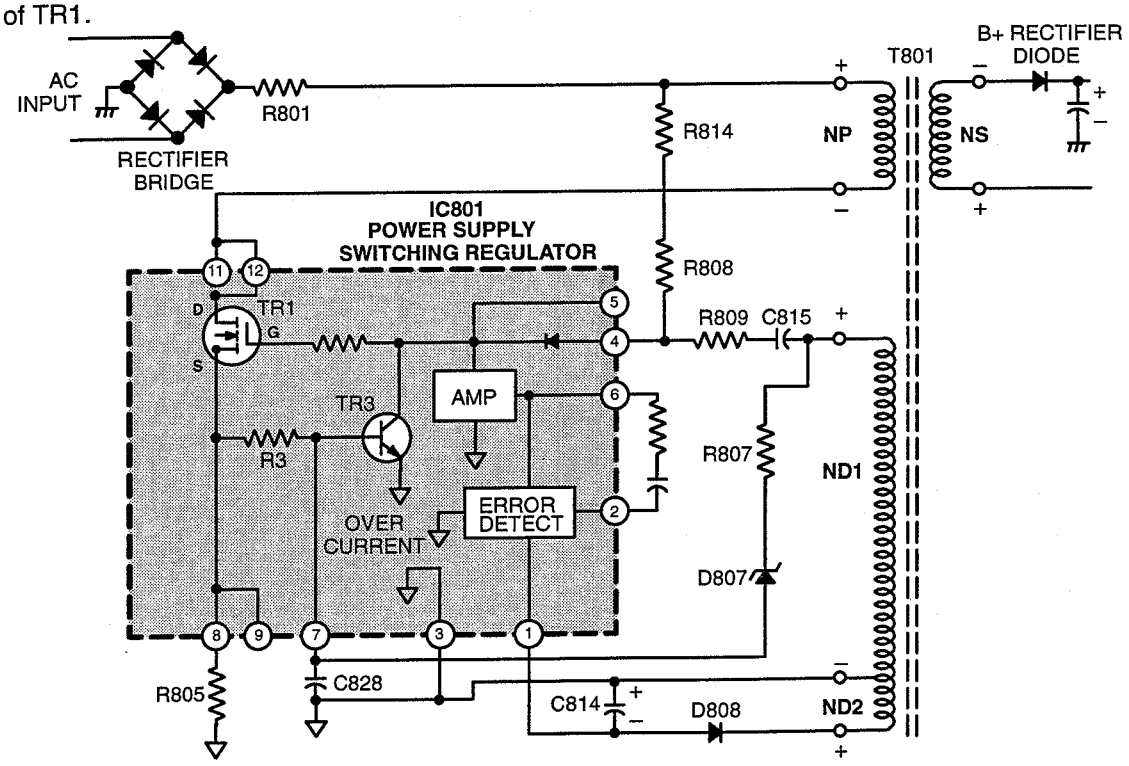
When TR1 turns OFF, the energy stored in T801 primary winding (NP) collapses and induces an opposite polarity voltage across the secondary windings (NS). B+ Rectifier diodes now conduct and allow current flow. When the total energy has collapsed at the primary winding, the ND2 winding also has a low voltage. The voltage across IC801 Pins 1 and 3 is now less than 40.5V and the internal error amp turns OFF to allow TR1 to conduct again. Reverse voltage polarity is again induced across the primary winding. This series of events repeats and the voltages of the secondary windings increase. When TR1 turns OFF, the energy is transferred to the secondary windings and TR1 is turned back on by the backswing. A stable oscillation begins.

**Over Current/Voltage Protection**

The over current/voltage protection circuit consist of IC801 internal components R3,TR3 and external components R805 (Pins 8, 9), R807, D807 (Pin7). Capacitor C828 (Pin 7) filters the base bias voltage of internal transistor TR3.

When output power increases because of a defect in a B+ source and excessive current flows, the Source current of TR1 increases. The voltage drop across R805 increases to cause oscillation frequency to decrease. Thus output voltage lowers. In other words, when the voltage drop across R805 increases, the base bias for TR3 also increases. When the bias reaches 0.6V,TR3 conducts and loads down the TR1 Gate bias to turn TR1 OFF. At the same time, the ND1 winding's current flows through R807 and D807 to produce a negative voltage and prevents TR1 from turning ON, as an overvoltage protection.

The Source current of TR1 is a triangular wave shape. When output current increase, the on time of TR1 stays constant but the off time becomes longer. As a result, frequency decreases and the output power decreases for over current/voltage protection.



# Power Supply Protection

A new feature has been added to the NA3D chassis family. MPU (IC001). Pin 19 is a dual function Pin. The ACTION button function is activated when Pin 19 voltage is 0.588V or less. An Over Voltage Protect function is activated when Pin 19 voltage is 3.2V or higher.

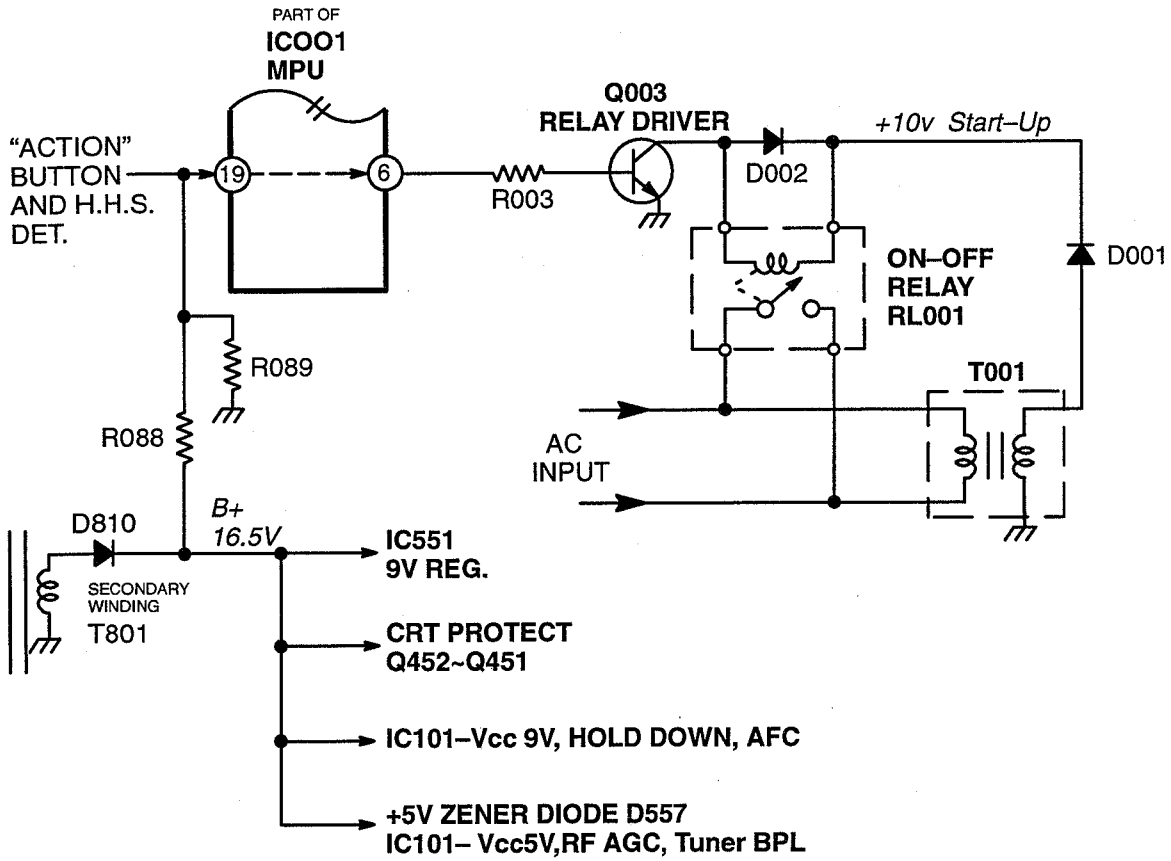
With the Receiver on, the power supply B+ 16.5V is monitored and voltage divided by R088/R089. As long as the voltage at IC001 Pin 19 is 0.6V~3.1V (depending on power supply operation) the Receiver operates normally.

If a major power supply switching I.C. failure occurs, the power supply may far exceed the normal +16.5V ±2V specification. IC001 Pin 19 voltage will increase above 3.2V and internal circuitry of the IC will cause Pin 6 (power) to go low. When this happens, the base of Q003 is held low and it can not conduct. Relay RL001 deenergizes to open the on contact in the relay and shuts the Receiver off.

This condition will remain until AC power is momentarily disconnected.

If when pressing the power button after AC is applied again and the Receiver comes on but goes off after a few seconds, there is a problem in the Receiver's power supply.

**WARNING:** Because Pin 19 is a dual function Pin, do not press the "ACTION" button on the Receiver. Pressing the button when the above symptom appears will inhibit the Overvoltage Protection and if the Receiver is powered on again, severe damage may happen to the entire chassis. If IC801 is changed to correct a power supply failure, also check or change D806, D807and D808 before reapplying power to the chassis. During a major failure, these components can fail, causing the I.C. to appear to operate normally, but it may run very hot, leading to another I.C. failure very quickly.



# Horizontal Hold Down Circuit

This circuit protects against excessive high voltage and CRT beam current. If for any reason high voltage and/or CRT beam current exceeds a predetermined level, the Hold Down Circuit operates to increase horizontal frequency. If the level increases more, the Hold Down Circuit will blank the CRT.

CRT heater voltage from pin 6 of flyback transformer (FBT) T551 is rectified by diode D531. This voltage is directly proportional to high voltage variations. The voltage is filtered and divided down by precision resistors R532/R533 to approximately 2.4V and applied to Pin 49 (Hold Down) of IC101. With this voltage as a normal condition, the Hold Down Circuit is inactive and has no effect on horizontal frequency or blanking the CRT.

The Hold Down Circuit inside IC101 is a (NPN) differential amp. One base of the differential amp is connected to Pin 49 (approximately 2.4V). The other is connected to Pin 51 through an internal voltage divided of equal resistance. Pin 51 is clamped at a 6V DC reference voltage zoner zener diode D532. The voltage at the base of the differential amp is 3V. (1/2 of the reference voltage, 6V)

Basically, the Hold Down Circuit compares the voltage at Pin 49 (approximately 2.4V) to half of Pin 51 (clamped 6V). If CRT heater pulse amplitude from T551 (representative of high voltage) increases, the positive voltage at the cathode of D531 and at Pin 49 of IC101 also increase.

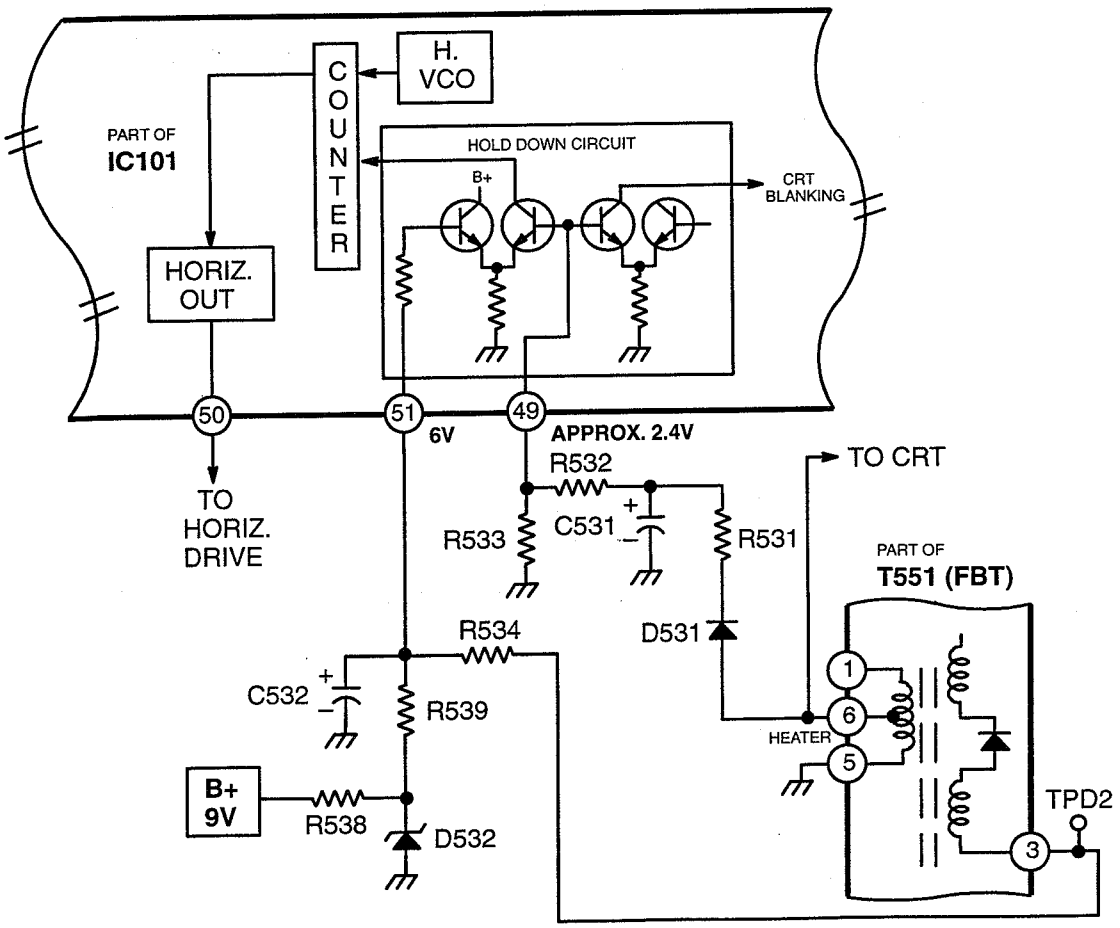
When the increased DC voltage at Pin 49 exceeds half of the Pin 51 reference voltage by a predetermined amount, the Hold Down Circuit (differential amp) changes conduction state and shifts the horizontal count down for a higher sweep frequency (out of sync condition) to prevent unsafe operation. For further safety when the Pin 49 voltage is extremely excessive, another internal differential amp changes state to blank the CRT.

An increase in CRT beam current produces more negative ABL voltage at Pin 3 of T551 (FBT) which is coupled to Pin 51 of IC101 via resistor R534. This increased negative voltage opposes the positive voltage at Pin 51 and lowers the DC reference voltage to less than 6V. This in turn causes the Hold Down Circuit to operate sooner when Pin 49 voltage increases.

Thus excessive levels of high voltage and/or increased CRT beam current cause determining of the horizontal oscillator frequency and eventual blanking of the CRT to assure operation within safe limits.

The B+ circuit and the Hold Down Circuit are not adjustable. If components in the designated areas of the schematic for critical parts are changed, operation of the Hold Down Circuit must be checked to insure that high voltage and CRT beam current does not exceed safe operation parameters. Check the following for possible failure:

1. Measure the DC voltage at Pin 49 of IC101 (reading should be close to +2.4V). If not, check D531, R531, C531, R532, R533 and IC101.
2. Measure the DC voltage at Pin 51 of IC101. (reading should be +6V) if not, check R534, C532, R539, D532, R538 and IC101.



# CRT Protection Circuit

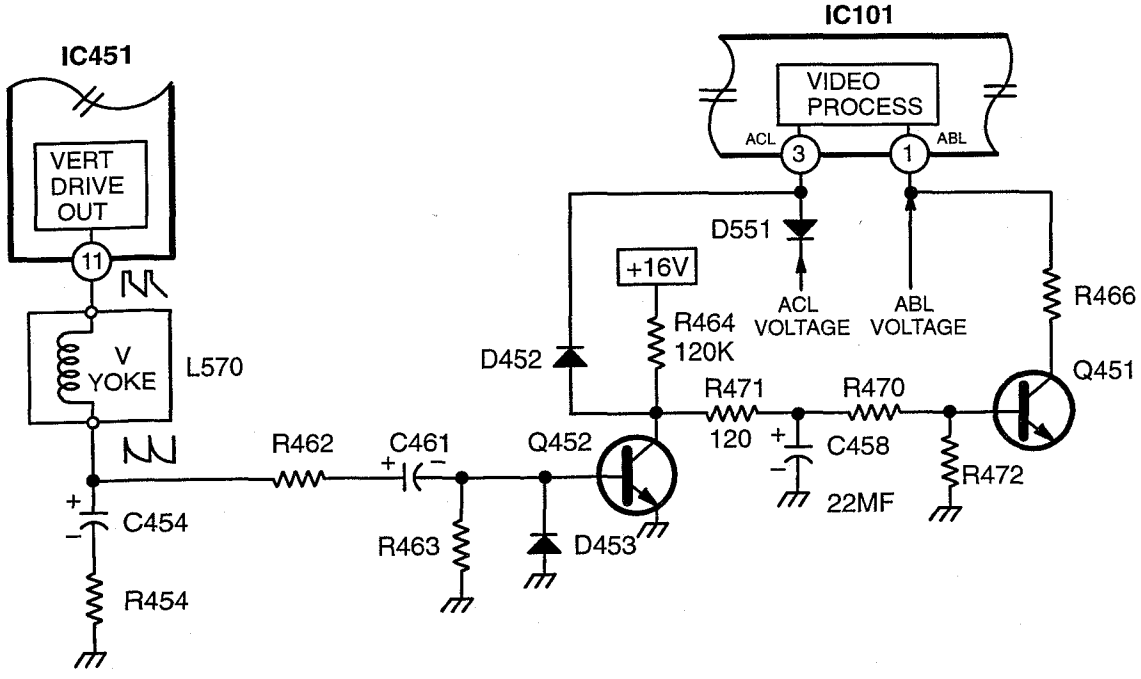
The CRT Protection Circuit is made up of transistors Q452 and Q451. The circuit blanks the CRT in the event of vertical sweep loss.

During normal operation, Q452 monitors vertical sweep by being connected to the low side of the vertical yoke L570. When Q452 is off, C458 starts to charge up from the 16V source through resistors R464 and R471. The RC time constant is such that the charging is slow. When Q452 is conducting, C458 discharges through R471 and the transistor to ground. The RC time constant is such that the discharge is fast. The slow charging and fast discharging along with voltage divider R470/R472 prevents sufficient bias for transistor Q451 to conduct. With Q451 not conducting, Pin 1 of IC101 is high and ABL functions normally.

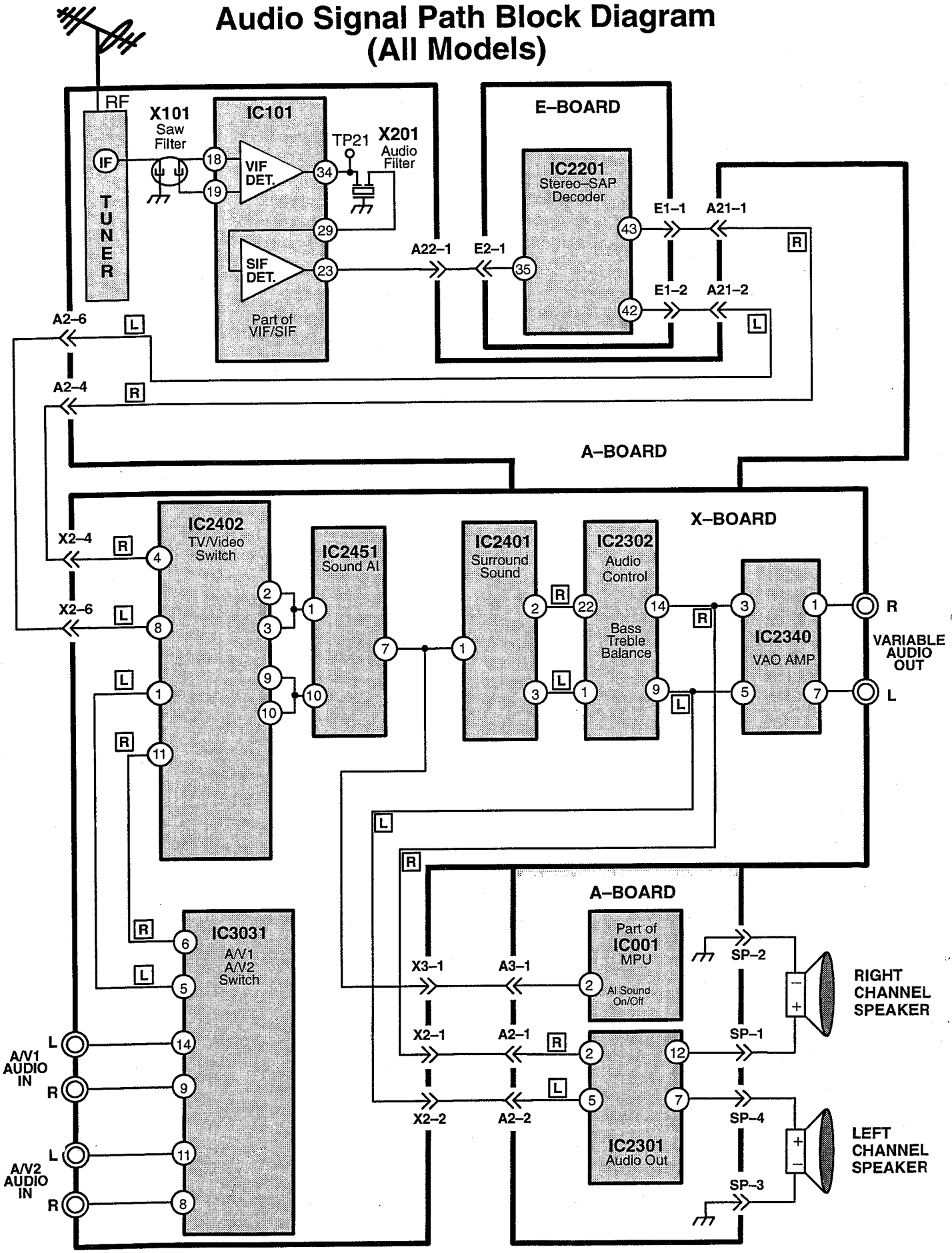
If yoke current ceases (due to an open yoke or no voltage at IC451 Pin 11), there is no base bias for transistor Q452. The transistor is now always non conductive. Capacitor C458 is now allowed to charge a longer time to supply enough bias through voltage divider R470/R472 for Q451 to conduct. When it does, the voltage at Pin 1 of IC101 goes low and cuts off CRT beam current.

Diode D452 is added to the collector of Q452 to prevent the circuit from operation when Pin 3 of IC101 is grounded for Service Switch function when setting CRT cutoff.

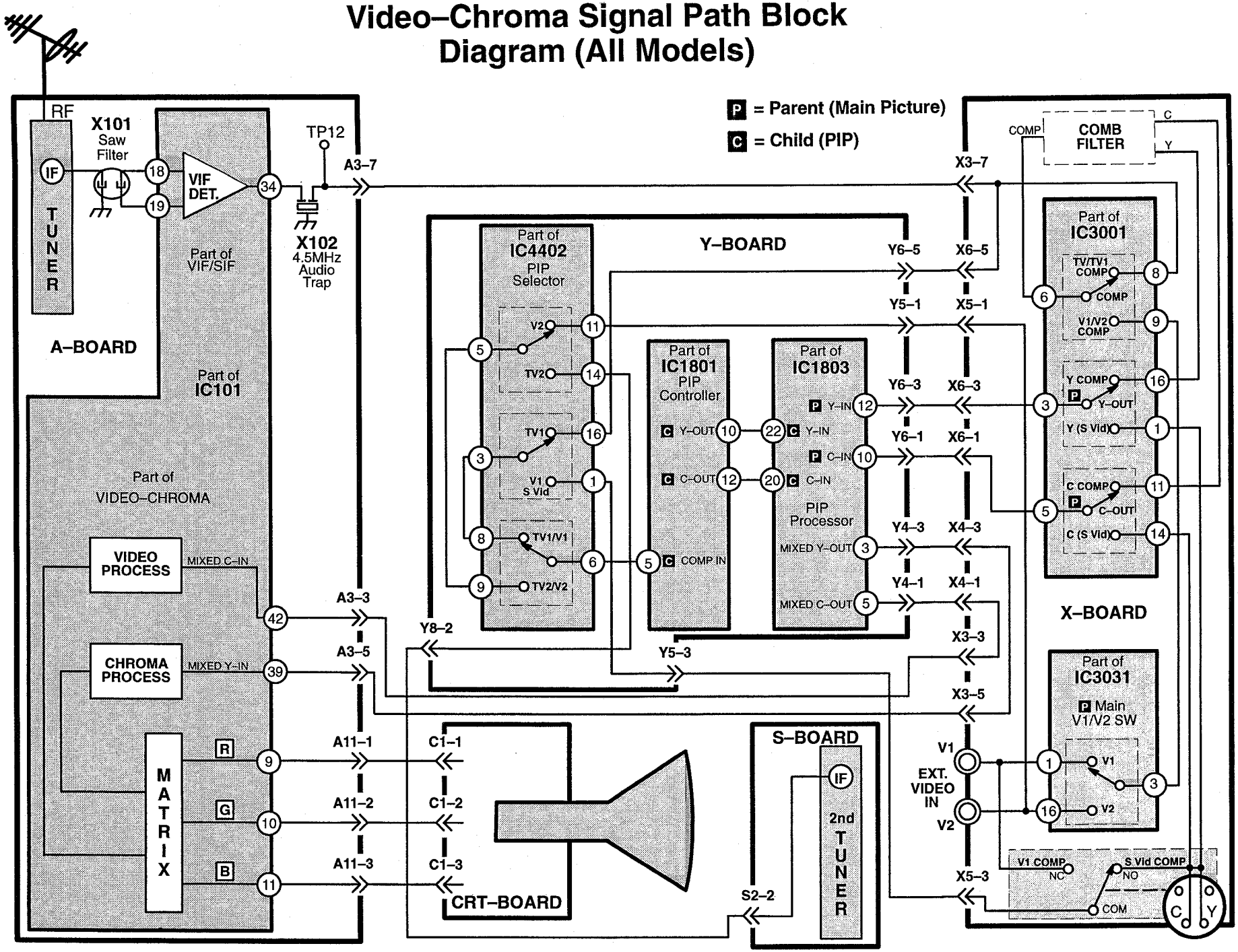
It is important for CRT life that this circuit be checked before returning a repaired receiver to a customer. A quick test is to short Q452 base to ground. The CRT should blank. If not, troubleshoot the circuit for cause.



# Audio Signal Path Block Diagram (All Models)



# Video–Chroma Signal Path Block Diagram (All Models)



# Service Notes

## Leadless Chip Components

Chip transistors must be replaced with identical chip components due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chip capacitor or resistor board solder pads may have holes thru the board but hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor replacement may also be limited for the same reason. It is recommended that identical chip components be used for replacement purposes.

Chip resistors have a three digit numerical resistance code – 1st and 2nd significant digits and a multiplier. Example: 162=1600 or 1.6K ohm resistor, 0=0 ohms (jumper).

Chip capacitors generally do not have the value indicated. The body color indicates a general range of capacity.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor. See coding chart.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

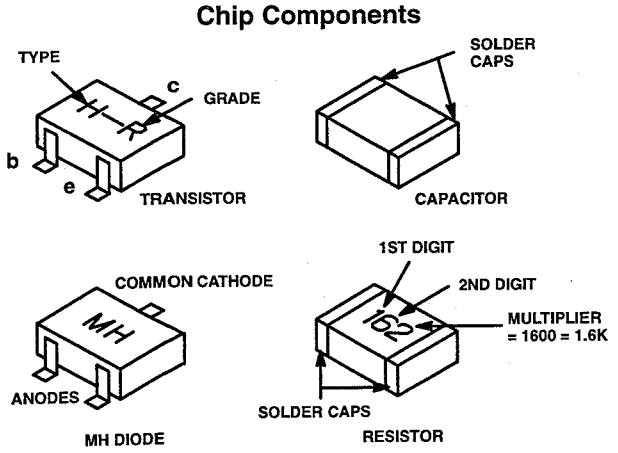
## Component Removal

1. Use solder wick to remove solder from component end caps or terminals.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

## Chip Component Installation

1. Put small amount of solder on board soldering pads.
2. Hold chip component against soldering pads with tweezers or a miniature alligator clip and apply heat to pad area with 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.
3. Remove iron and continue to hold component against pads until solder solidifies.

### Chip Components

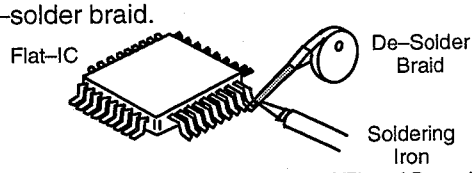



## How to Replace Flat–IC

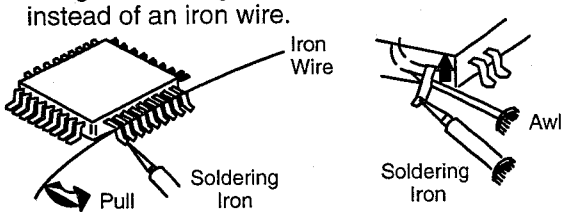
**– Tools Required –**

- Soldering iron
- De–solder braids
- Iron wire or small awl
- Magnifier

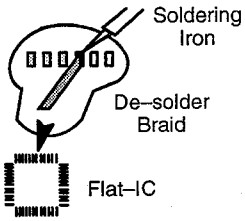
1. Remove the solder from all pins of Flat–IC by using de–solder braid.



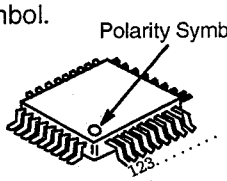

2. Put an iron wire under the pins of Flat–IC and pull it in the directions indicated while heating the pins using a soldering iron. A small awl can be used instead of an iron wire.



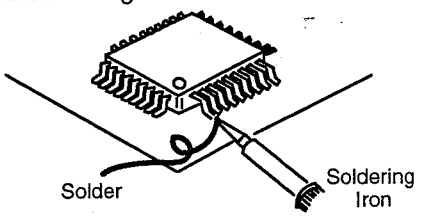

3. Remove the solder from all pads of Flat–IC by using de–solder braid.



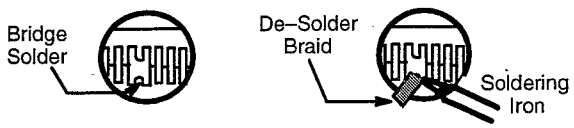

4. Put the new Flat–IC in place (apply the pins of Flat–IC to the soldering pads where the pins must be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol.




5. Solder all pins to the soldering pads using a fine tipped soldering iron.




6. Check with a magnifier for solder bridge between the pins or dry joint between pins and soldering pads. To remove solder bridge, use de–solder braid as shown in figure.




**NOTE:** ***These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of IC's when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the compound loose.***

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | | **CAPRISTORS** |
| **CRA801** | **EXNG131P365** | **RES–CAP 130PF/3.6 MEG** |
| **CRA802** | **EXNG131P365** | **RES–CAP 130PF/3.6 MEG** |
| | | **CAPACITORS** |
| C001 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C002 | ECA1EM4R7GB | CAP,E 4.78F/25V |
| C003 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C004 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C005 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C006 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C007 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C008 | ECA0JM331GB | CAP,E 330UF/10V |
| C009 | ECA1CM100GB | CAP,E 10/16V |
| C010 | ECA1CM100GB | CAP,E 10/16V |
| C011 | ECA1CM100GB | CAP,E 10/16V |
| C012 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C014 | ECA0JM102GB | CAP,E 1000UF/6.3V |
| C015 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C017 | ECA0JM101GB | CAP,E 100UF/6.3V |
| C019 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C021 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C022 | ECCF1H330JC | CAP,C 33PF–J–50V |
| C023 | ECCF1H330JC | CAP,C 33PF–J–50V |
| C024 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C025 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C026 | ECA1CM102GE | CAP,E 1000UF/16V |
| C035 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C036 | ECA0JM101GB | CAP,E 100UF/6.3V |
| C037 | ECA0JM101GB | CAP,E 100UF/6.3V |
| C045 | ECA1CM471GB | CAP,E 470UF/10V |
| C046 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C047 | ECA1CM221GB | CAP,E 220/16V |
| C060 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C064 | ECKF1H392KB | CAP,C .0039–K–50V |
| C101 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C102 | ECA1CM100GB | CAP,E 10/16V |
| C103 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C104 | ECA1HMR22GB | CAP,E .22UF/50V |
| C105 | ECCF1H270JC | CAP,C 27PF–J–50V |
| C106 | ECKF1H122KB | CAP,C .0012UF–K–50V |
| C107 | ECA1HMR47GB | CAP,E .47UF/50V |
| C109 | ECA0JM101GB | CAP,E 100UF/6.3V |
| C110 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C113 | ECA1CM100GB | CAP,E 10/16V |
| C114 | ECKF1H102KB | CAP,C .001UF–K–50V |
| C123 | ECCF1H010CC | CAP,C 1PF–C–50V |
| C126 | ECA1CM331GB | CAP,E 330/16V |
| C147 | ECCF1H330JC | CAP,C 33PF–J–50V |
| C151 | ECA1HMR22GB | CAP,E .22UF/50V |
| C152 | ECCF1H680JC | CAP,C 68PF–J–50V |
| C153 | ECCF1H150JC | CAP,C 15PF–J–50V |
| C201 | ECCF1H680JP | CAP,C 68PF–J–50V |
| C202 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C203 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C207 | ECEA1CN100S | CAP,E 10UF/16V |
| C301 | ECEA1CN100S | CAP,E 10UF/16V |
| C302 | ECA1AM331GB | CAP,E 330UF/10V |
| C303 | ECA1CM220GB | CAP,E 22UF/16V |
| C304 | ECA1EM4R7GB | CAP,E 4.78F/25V |
| C305 | ECA1HMR33GB | CAP,E .33UF/50V |
| C306 | ECA1EM4R7GB | CAP,E 4.78F/25V |
| C309 | ECEA1HN010S | CAP,E 1UF/50V |
| C310 | ECA1CM100GB | CAP,E 10/16V |
| C311 | ECQB1H473KF | CAP,P .047UF–K–50V |
| C312 | ECA1CM220GB | CAP,E 22UF/16V |
| C313 | ECCF1H390K | CAP,C 39PF–K–50V |
| C315 | ECKF1H151KB | CAP,C 150PF–K–50V |
| C316 | ECKF1H181KB | CAP,C 180PF–K–50V |
| C351 | ECKF1H561KB | CAP,C 560PF–K–50V<br>CT–31G30TM CT–31G30UTM |
| C351 | ECKF1H821KB | CAP,C 820PF–K–50V<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |
| C352 | ECKF1H561KB | CAP,C 560PF–K–50V<br>CT–31G30TM CT–31G30UTM |
| C352 | ECKF1H821KB | CAP,C 820PF–K–50V<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |
| C353 | ECKF1H681KB | CAP,C 680PF–K–50V<br>CT–31G30TM CT–31G30UTM |
| C353 | ECKF1H821KB | CAP,C 820PF–K–50V<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |
| C355 | ECKD3D102KB | CAP,C .001UF–K–2KV |
| C357 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C401 | ECA1HMR33GB | CAP,E .33UF/50V |
| C402 | ECKF1H331KB | CAP,C 330PF–K–50V |
| C403 | ECEA1HN010S | CAP,E 1UF/50V |
| **C451** | **ECEA1CGE221** | **CAP,E 220UF/16V** |
| C452 | ECSF1EE105 | CAP,T 1.0UF/25V |
| C453 | ECEA1HFS2R2 | CAP,E 2.2UF/50V |
| C454 | ECEA1EGE102 | CAP,E 1000UF/25V |
| C455 | ECEA1VGE101 | CAP,E 100UF/35V |
| C456 | ECQB1H224KF | CAP,P .22UF–K–50V |
| C457 | ECEA1HGE0R1 | CAP,E .1UF/50V |
| C458 | ECA1EM4R7GB | CAP,E 4.78F/25V |
| C461 | ECEA1HGE010 | CAP,E 1UF/50V |
| C462 | ECQM1104JZ | CAP,P .1UF–J–100V |
| C464 | ECQB1H563JF | CAP,P .056UF–J–50V |
| C501 | ECKD2H821KB | CAP,C 820PF–K–500V<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |
| C501 | ECKF1H821KB | CAP,C 820PF–K–50V<br>CT–31G30TM CT–31G30UTM |
| C502 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C503 | ECQB1H103KF | CAP,P .01UF–K–50V |
| C504 | ECQB1H103KF | CAP,P .01UF–K–50V |
| C505 | ECQB1H223KF | CAP,P .022UF–K–50V<br>CT–31G30TM CT–31G30UTM |
| C505 | ECQB1H333KF | CAP,P .033UF–K–50V<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| C506 | ECA1AM221GB | CAP,E 220UF/10V |
| C507 | ECKF1H221KB | CAP,C 220PF–K–50V |
| C508 | ECQB1H223KF | CAP,P .022UF–K–50V |
| C509 | ECCF1H221JU | CAP,C 220PF–J–50V |
| C510 | ECCD2H100D | CAP,C 10PF–D–500V |
| C511 | ECKD2H821KB | CAP,C 820PF–K–500V |
| C515 | ECKD2H101KB | CAP,C 100PF–K–500V |
| C517 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C531 | ECA1EM330GB | CAP,E 33UF/25V |
| C532 | ECA1AM220GB | CAP,E 22UF/10V |
| C541 | ECCF1H680JP | CAP,C 68PF–J–50V |
| C542 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C543 | ECKF1H221KB | CAP,C 220PF–K–50V |
| C551 | ECA0JM222GE | CAP,E 2200UF/6.3V |
| C552 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C553 | ECA1CM100GB | CAP,E 10/16V |
| C555 | ECEA2EU220 | CAP,E 22UF/250V |
| C556 | ECKD2H561KB | CAP,C 560PF–K–500V |
| C557 | ECEA1CGE221 | CAP,E 220UF/16V |
| C558 | ECA1CM331GB | CAP,E 330/16V |
| C560 | ECEA2AU220 | CAP,E 22UF/100V |
| C561 | ECA1HM2R2GB | CAP,E 2.2UF/50V |
| **C562** | **ECQF2H434JS** | **CAP,P .43UF–J–200V** |
| | | **CT–31G30TM CT–31G30UTM** |
| **C562** | **ECQF2H474JS** | **CAP,P .47UF–J–200V** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **C563** | **ECWH12H103JS** | **CAP,P .01UF–J–1.2KV** |
| | | **CT–31G30TM CT–31G30UTM** |
| **C563** | **ECWH12H682JS** | **CAP,P .0068UF–J–1.2KV** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **C564** | **ECWH12H392JS** | **CAP,P .0039UF–J–1.2KV** |
| | | **CT–31G30TM CT–31G30UTM** |
| **C564** | **ECWH12H562JS** | **CAP,P .0056UF–J–1.2KV** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **C565** | **ECKD3D102JB** | **CAP,C .001UF–J–2KV** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **C565** | **ECKD3D821JB** | **CAP,C 820PF–J–2KV** |
| | | **CT–31G30TM CT–31G30UTM** |
| **C566** | **ECKD3D181JB** | **CAP,C 180PF–J–2KV** |
| **C567** | **ECQM2153JZ** | **CAP,P .015UF–J–200V** |
| | | **CT–31G30TM CT–31G30UTM** |
| C568 | ECQF2563JZH | CAP,P .056UF–J–200V |
| | | CT–31G30TM CT–31G30UTM |
| C568 | ECQM2274JZ | CAP,P .27UF–J–200V |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| **C569** | **ECEA160V33Z** | **CAP,E 33UF/160V** |
| C571 | ECEA1EGE100 | CAP,E 10UF/25V |
| C601 | ECCF1H101J | CAP,C 100PF–J–50V |
| C602 | ECCF1H150JU | CAP,C 15PF–J–50V |
| C607 | ECCF1H101J | CAP,C 100PF–J–50V |
| C754 | ECQB1H104KF | CAP,P .1UF–K–50V |

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | | CT–31G30TM CT–31G30UTM |
| C755 | ECQB1H104KF | CAP,P .1UF–K–50V |
| | | CT–31G30TM CT–31G30UTM |
| C756 | ECEA0JU221 | CAP,E 220UF/6.3V |
| | | CT–31G30TM CT–31G30UTM |
| C757 | ECA1VM102E | CAP,E 1000UF/35V |
| | | CT–31G30TM CT–31G30UTM |
| C759 | ECQE1395KN | CAP,P .068UF–K–100V |
| | | CT–31G30TM CT–31G30UTM |
| C801 | ECKD2H472PU | CAP,C .0047UF–P–500V |
| C802 | ECKD2H472PU | CAP,C .0047UF–P–500V |
| C803 | ECKD2H472PU | CAP,C .0047UF–P–500V |
| C804 | ECKD2H472PU | CAP,C .0047UF–P–500V |
| **C805** | **EC0S2DA471BB** | **CAP,E 470UF/160V** |
| **C806** | **ECQU2A153MN** | **CAP,P .015UF–M–250VAC** |
| **C807** | **ECQU2A153MN** | **CAP,P .015UF–M–250VAC** |
| **C809** | **ECQU2A224MN** | **CAP,P .22UF–M–250VAC** |
| C810 | ECQM2473KZ | CAP,P .047UF–K–200V |
| C811 | ECKD3A102KB | CAP,C .001UF–K–1KV |
| C812 | ECKD3A102KB | CAP,C .001UF–K–1KV |
| C813 | ECKD2H152KB | CAP,C .0015UF–K–500V |
| C814 | ECEA1JFS220 | CAP,E 22UF/63V |
| C815 | ECQB1H273KF | CAP,P .027UF–K–50V |
| C816 | ECKD3A152KB | CAP,C .0015UF–K–1KV |
| C817 | ECKD3A102KB | CAP,C .001UF–K–1KV |
| **C818** | **EC0S2DA221B4** | **CAP,E 220UF/200V** |
| C819 | ECKD2H391KB | CAP,C 390PF–K–500V |
| C820 | ECEA1VGE102 | CAP,E 1000UF/35V |
| C821 | ECKD2H102KB | CAP,C .001UF–K–500V |
| **C822** | **ECEA1EGE102** | **CAP,E 1000UF/25V** |
| C823 | ECKD2H561KB | CAP,C 560PF–K–500V |
| C824 | ECEA1EGE222 | CAP,E 2200UF/25V |
| C828 | ECQB1H473KF | CAP,P .047UF–K–50V |
| C829 | ECKD2H331KB | CAP,C 330PF–K–500V |
| C831 | ECA1VM102GE | CAP,E 1000UF/35V |
| C1021 | ECEA1AFS470 | CAP,E 47UF/10V |
| C1022 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C1801 | ECEA1HKA010 | CAP,E 1.0UF/50V |
| C1802 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1803 | ECEA1HKA010 | CAP,E 1.0UF/50V |
| C1805 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1806 | ECEA1CKA100 | CAP,E 10UF/16V |
| C1807 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1808 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1809 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1810 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1811 | ECEA1EKA4R7 | CAP,E 4.7UF/25V |
| C1812 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1813 | ECEA0JKA331Q | CAP,E 330UF/6.3V |
| C1814 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1820 | ECUX1H390JCX | CAP,C 39PF–J–50V |
| C1837 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C1838 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C2130 | ECA1CM102GB | CAP,E 1000UF/16V |
| C2131 | ECA1CM331GB | CAP,E 330/16V |
| C2132 | ECA1CM100GB | CAP,E 10/16V |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

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| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| C2133 | ECA1HMR47GB | CAP,E .47UF/50V |
| C2137 | ECQB1H104JF | CAP,P .1UF–J–50V |
| C2138 | ECA0JM101GB | CAP,E 100UF/6.3V |
| C2139 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C2140 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C2141 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C2142 | ECA1HM330GB | CAP,E 33/50V |
| C2201 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2202 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2203 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2204 | ECQB1H104JF | CAP,P .1UF–J–50V |
| C2205 | ECEA1HUR68 | CAP,E .68UF/50V |
| C2206 | ECEA1CU101 | CAP,E 100UF/16V |
| C2207 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2208 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2209 | AP106K016CAE | CAP,T 10UF/16V |
| C2210 | ECQB1H104KF | CAP,P .1UF–K–50V |
| C2211 | AP335K016CAE | CAP,T 3.3UF/16V |
| C2212 | ECEA1HU010 | CAP,E 1UF/50V |
| C2213 | ECEA1HFSR47 | CAP,E .47UF/50V |
| C2214 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2215 | ECQB1H104KF | CAP,P .1UF–K–50V |
| C2216 | ECUX1H102JCX | CAP,C .001UF–J–50V |
| C2217 | ECQB1H683JF | CAP,P .068UF–J–50V |
| C2218 | ECUX1H222KBX | CAP,C .0022UF–K–50V |
| C2219 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C2220 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2301 | ECA1EM101GB | CAP,E 100/25V |
| C2302 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2303 | ECKF1H392KB | CAP,C .0039–K–50V |
| C2304 | ECKF1H392KB | CAP,C .0039–K–50V |
| C2305 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2306 | ECA1EM101GB | CAP,E 100/25V |
| C2307 | ECA1CM102GB | CAP,E 1000UF/16V |
| C2308 | ECEA1EN470U | CAP,E 47UF/25V |
| C2309 | ECQB1H104KF | CAP,P .1UF–K–50V |
| C2310 | ECQB1H104KF | CAP,P .1UF–K–50V |
| C2311 | ECEA1EN470U | CAP,E 47UF/25V |
| C2312 | ECA1CM102GB | CAP,E 1000UF/16V |
| C2313 | ECA1EM102GB | CAP,E 1000UF/25V |
| C2315 | ECA1EM100GB | CAP,E 10UF/25V |
| C2316 | ECA1EM101GB | CAP,E 100/25V |
| C2318 | ECKF1H332KB | CAP,C .0033UF–K–50V |
| C2319 | ECKF1H332KB | CAP,C .0033UF–K–50V |
| C2320 | ECA1AM222GE | CAP,E 2200UF/10V |
| C2321 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2322 | ECA1CM100GB | CAP,E 10/16V |
| C2323 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C2324 | ECQB1H683KF | CAP,P .068UF–K–50V |
| C2325 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C2326 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C2327 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C2328 | ECQB1H683KF | CAP,P .068UF–K–50V |
| C2340 | ECA1CM100GB | CAP,E 10/16V |
| C2341 | ECA1CM100GB | CAP,E 10/16V |
| C2342 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2343 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2344 | ECA1CM221GB | CAP,E 220/16V |
| C2403 | ECA1CM470GB | CAP,E 47UF/16V |
| C2404 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C2405 | ECA1CM100GB | CAP,E 10/16V |
| C2406 | ECQB1H823KF | CAP,P .082UF–K–50V |
| C2407 | ECQB1H104KF | CAP,P .1UF–K–50V |
| C2408 | ECUX1H222KBX | CAP,C .0022UF–K–50V |
| C2409 | ECUX1H223KBX | CAP,C .022UF–K–50V |
| C2410 | ECUX1H223KBX | CAP,C .022UF–K–50V |
| C2451 | ECEA1HN010S | CAP,E 1UF/50V |
| C2452 | ECEA1HN010S | CAP,E 1UF/50V |
| C2453 | ECA1HM4R7GB | CAP,E 4.7UF/50V |
| C2455 | ECA1CM100GB | CAP,E 10/16V |
| C2456 | ECA1CM100GB | CAP,E 10/16V |
| C2457 | ECA1HM4R7GB | CAP,E 4.7UF/50V |
| C2458 | ECA1HM4R7GB | CAP,E 4.7UF/50V |
| C3001 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C3002 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C3003 | ECA1CM100GB | CAP,E 10/16V |
| C3004 | ECA1AM220GB | CAP,E 22UF/10V |
| C3005 | ECA1AM220GB | CAP,E 22UF/10V |
| C3006 | ECA1CM470GB | CAP,E 47UF/16V |
| C3007 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C3008 | ECUX1H151JCX | CAP,C 150PF–J–50V |
| C3031 | ECA1CM100GB | CAP,E 10/16V |
| C3032 | ECA1CM100GB | CAP,E 10/16V |
| C3033 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C3034 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C3035 | ECA1HM010GB | CAP,E 1.0UF/50V |
| C3036 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C3071 | ECA1CM220GB | CAP,E 22UF/16V |
| C3072 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C3201 | ECA1AM470GB | CAP,E 47UF/10V |
| C3202 | ECQB1H473KF | CAP,P .047UF–K–50V |
| C3203 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C3204 | ECUX1H103KBX | CAP,C .01UF–K–50V |
| C3206 | ECEA1AN220S | CAP,E 22UF/10V |
| C3207 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C3208 | ECUX1H101JCX | CAP,C 100PF–J–50V |
| C3209 | ECUX1H121JCX | CAP,C 120PF–J–50V |
| C3212 | ECUX1H390JCX | CAP,C 39PF–J–50V |
| C4353 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4354 | ECEA1CKA220 | CAP,E 22UF/16V |
| C4355 | ECEA1CKA100 | CAP,E 10UF/16V |
| C4356 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4357 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4358 | ECA0JM331GB | CAP,E 330UF/10V |
| C4359 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4360 | ECEA1CKA220 | CAP,E 22UF/16V |
| C4361 | ECEA1HKA2R2 | CAP,E 2.2UF/50V |
| C4362 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4363 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4364 | ECEA1HKA3R3 | CAP,E 3.3UF/50V |
| C4365 | ECEA1HKAR47 | CAP,E .47UF/50V |
| C4367 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| C4368 | ECUX1H681KBX | CAP,C 680PF–K–50V |
| C4369 | ECEA1HKAR47 | CAP,E .47UF/50V |
| C4370 | ECUX1H391KBX | CAP,C 390PF–K–50V |
| C4371 | ECEA1HKA010 | CAP,E 1.0UF/50V |
| C4374 | ECUX1H122JCX | CAP,C .0012UF–J–50V |
| C4375 | ECEA1HKA010 | CAP,E 1.0UF/50V |
| C4380 | ECRHA030E81 | TRIMMER: 30PF |
| C4390 | ECA0JM331GB | CAP,E 330UF/10V |
| C4407 | ECUX1H103ZFX | CAP,C .01UF–Z–50V |
| C4408 | ECUX1H101JCX | CAP,C 100PF–J–50V |
| C4411 | ECEA1CKA100 | CAP,E 10UF/16V |
| C4412 | ECEA1CKN100 | CAP,E 10UF/16V |
| C4414 | ECEA1CKN100 | CAP,E 10UF/16V |
| C4415 | ECEA1CKA100 | CAP,E 10UF/16V |
| C4416 | ECEA1CKA100 | CAP,E 10UF/16V |
| C4420 | ECUX1H820JCX | CAP,C 82PF–J–50V |
| | | **DIODES** |
| D001 | ERA15–01 | DIODE |
| D002 | MA167 | DIODE |
| D003 | MA4047 | DIODE, ZENER |
| D004 | MA4062M | DIODE, ZENER |
| D006 | MA165 | DIODE |
| D022 | MA165 | DIODE |
| D025 | MA165 | DIODE |
| D301 | MA165 | DIODE |
| D303 | MA165 | DIODE |
| D352 | MA4062L | DIODE, ZENER |
| D353 | MA4062L | DIODE, ZENER |
| D355 | MA4062L | DIODE, ZENER |
| D451 | ERA15–01 | DIODE |
| D452 | MA150 | DIODE |
| D453 | MA165 | DIODE |
| D454 | MA4120M | DIODE |
| D455 | MA4110H | DIODE, ZENER |
| D456 | MA165 | DIODE |
| D501 | MA4082L | DIODE |
| **D531** | **AS01** | **DIODE** |
| **D532** | **MA4062L** | **DIODE, ZENER** |
| D542 | MA4051M | DIODE, ZENER |
| D551 | MA165 | DIODE |
| D553 | MA165 | DIODE |
| **D554** | **AS01** | **DIODE** |
| D555 | MA165 | DIODE |
| D556 | MA4360H | DIODE, ZENER |
| D557 | MA2051 | DIODE |
| **D558** | **RS3FS** | **DIODE** |
| **D559** | **TVSRU3M** | **DIODE** |
| **D801** | **TVSRM11B** | **DIODE** |
| **D802** | **TVSRM11B** | **DIODE** |
| **D803** | **TVSRM11B** | **DIODE** |
| **D804** | **TVSRM11B** | **DIODE** |
| **D805** | **TRPW5B0M030D** | **THERMISTOR CT–31G30TM CT–31G30UTM** |
| **D805** | **TRPW5B0M050D** | **THERMISTOR CT–27G30TM CT–27G30CTC CT–27G30UTM** |
| D806 | BYD33M–113 | DIODE |
| D807 | MA1075L | DIODE |
| D808 | AU01 | DIODE |
| **D809** | **RU30ALFS1** | **DIODE** |
| **D810** | **RU3YX–M** | **DIODE** |
| **D811** | **RU3YX–MLF–C2** | **DIODE** |
| **D812** | **AU02** | **DIODE** |
| D1801 | MA151K | DIODE |
| D2110 | MA4300H | DIODE |
| D3001 | MA165 | DIODE |
| D3002 | MA165 | DIODE |
| D3005 | MA3110M | DIODE |
| D3075 | MA3110M | DIODE |
| D3076 | MA3110M | DIODE |
| D3077 | MA3110M | DIODE |
| D3078 | MA3110M | DIODE |
| D3079 | MA3110M | DIODE |
| D3082 | MA3110M | DIODE |
| D3083 | MA3110M | DIODE |
| D4420 | MA3110 | DIODE |
| | | **FUSES** |
| **F001** | **XBA1C40NU100** | **FUSE 4.0A/125V** |
| | | **INTEGRATED CIRCUITS** |
| IC001 | MN1873234HYJ | INT CKT |
| IC002 | 24LC02BIP | ROM |
| **IC101** | **AN5163K** | **INT CKT** |
| **IC451** | **LA7836–TV** | **INT CKT** |
| **IC551** | **AN7809** | **INT CKT** |
| IC552 | AN78M05 | PLUS 5V AVR |
| IC553 | AN78L12 | INT CKT |
| **IC801** | **STK730–020** | **INT CKT** |
| IC1801 | M65607SP | INT CKT |
| IC1802 | MN47464L–12 | INT CKT |
| IC1803 | M52694P | PIP PROCESSER |
| IC1804 | MN1280R | INT CKT |
| IC2201 | AN5817NF | MTS IC |
| IC2301 | AN7147N | INT CKT |
| IC2302 | CXA1279AS | INT CKT |
| IC2340 | BA15218N | INT CKT |
| IC2401 | UPC1891ACY | INT CKT |
| IC2402 | MC14066BCP | INT CKT |
| IC2451 | AN5285K | SOUND AI |
| IC3001 | M52055P | INT CKT |
| IC3031 | M52055P | INT CKT |
| IC4402 | M52055P | INT CKT |
| | | **COILS** |
| DEG | 0LK19036–1A | COIL, DEGAUSSING CT–31G30TM CT–31G30UTM |
| DEG | 0LK19045A | COIL, DEGAUSSING 27" CT–27G30TM CT–27G30CTC CT–27G30UTM |
| DY | 0LY15414F | YOKE, DEFLECTION CT–31G30TM CT–31G30UTM |
| **DY** | **TLY15525F** | **YOKE, DEFLECTION CT–27G30TM CT–27G30CTC CT–27G30UTM** |

# REPLACEMENT PARTS LIST

**(Models: CT-27G30T, CT-31G30T, CT-27G30C, CT-27G30UT, CT-31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| L001 | EXCELSA24 | FERRITE BEAD |
| L002 | EXCELSA35 | FERRITE BEAD |
| L003 | EXCELSA39 | FERRITE BEAD |
| L004 | EXCELDR35 | FERRITE BEAD |
| L005 | TLUABTA100K | COIL, PEAKING 10UH |
| L006 | EXCELSA35 | FERRITE BEAD |
| L009 | ELESN120KA | COIL, PEAKING 12UH |
| L011 | ELESN1R0KA | COIL, PEAKING 1.0UH |
| L021 | ELESN390KA | COIL, PEAKING 39UH |
| L101 | ELESN150KA | COIL, PEAKING 15UH |
| L103 | EIV7EN041B | COIL, AFT |
| L105 | EIV7EN053B | VCO |
| L106 | TLQ012K205C | COIL, PEAKING 1.2UH |
| L107 | TLQ012K205C | COIL, PEAKING 1.2UH |
| L108 | TLUABTA1R0K | COIL, PEAKING 1.0UH |
| L109 | ELESN1R0KA | COIL, PEAKING 1.0UH |
| L111 | ELESN270KA | COIL, PEAKING 27UH |
| L201 | EIS7ES004B | COIL, QUADRATURE |
| L351 | TLUABTA151K | COIL, PEAKING 150UH |
| L352 | EXCELSA24 | FERRITE BEAD |
| L353 | EXCELSA24 | FERRITE BEAD |
| L354 | EXCELDR25C | FERRITE BEAD |
| **L551** | **TLH6621P** | **COIL, LINEARITY** |
| | | **CT-27G30TM CT-27G30CTC** |
| | | **CT-27G30UTM** |
| **L551** | **TLH6663P** | **COIL, LINEARITY** |
| | | **CT-31G30TM CT-31G30UTM** |
| L552 | EXCELSA24 | FERRITE BEAD |
| L553 | EXCELSA24 | FERRITE BEAD |
| L557 | 0SC9002 | FERRITE BEAD |
| L558 | EXCELSA24 | FERRITE BEAD |
| L559 | EXCELSA35 | FERRITE BEAD |
| L563 | ELEIN330KA | COIL, 33UH |
| L571 | ELEIN680KA | COIL |
| L601 | ELESN100KA | COIL, PEAKING 10UH |
| **L751** | **TLH15727** | **REACTOR, PINCUSHION** |
| | | **CT-31G30TM CT-31G30UTM** |
| **L801** | **ELF18D666A** | **LINE FILTER** |
| L802 | ELEIN330KA | COIL, 33UH |
| L803 | EXCELSA39 | FERRITE BEAD |
| L804 | EXCELSA39 | FERRITE BEAD |
| L805 | 0SC9002 | FERRITE BEAD |
| L806 | EXCELSA35 | FERRITE BEAD |
| L807 | 0SC9002 | FERRITE BEAD |
| L808 | 0SC9002 | FERRITE BEAD |
| L809 | 0SC9002 | FERRITE BEAD |
| L810 | EXCELSA24 | FERRITE BEAD |
| L811 | EXCELSA35 | FERRITE BEAD |
| L813 | 0SC9002 | FERRITE BEAD |
| L814 | 0SC9002 | FERRITE BEAD |
| L815 | 0SC9002 | FERRITE BEAD |
| L816 | 0SC9002 | FERRITE BEAD |
| L819 | EXCELSA35 | FERRITE BEAD |
| L1802 | ELESN100KA | COIL, PEAKING 10UH |
| L1803 | ELESN4R7KA | COIL |
| L2110 | ELESN120KA | COIL, PEAKING 12UH |
| L2111 | ELESN120KA | COIL, PEAKING 12UH |
| L3001 | ELESN100KA | COIL, PEAKING 10UH |
| L3201 | EFDEN645B35B | DELAY LINE |
| L3202 | EIK1EG024B | CHROMA TRAP |
| L3203 | ELESN180KA | COIL, PEAKING 18UH |
| L3204 | ELESN100KA | COIL, PEAKING 10UH |
| L4351 | ELESN2R2KA | COIL, PEAKING 2.2UH |
| L4352 | ELESN100KA | COIL, PEAKING 10UH |
| L4353 | EXCELDR25C | FERRITE BEAD |
| L4402 | ELESN100KA | COIL, PEAKING 10UH |
| | | **TRANSISTORS** |
| Q002 | JC501PQ | TRANSISTOR |
| Q003 | JC501PQ | TRANSISTOR |
| Q004 | JA101PQ | TRANSISTOR |
| Q007 | JC501PQ | TRANSISTOR |
| Q008 | JC501PQ | TRANSISTOR |
| Q015 | JA101PQ | TRANSISTOR |
| Q101 | JC501PQ | TRANSISTOR |
| Q103 | JC501PQ | TRANSISTOR |
| Q305 | JA101PQ | TRANSISTOR |
| Q306 | JC501PQ | TRANSISTOR |
| Q307 | JC501PQ | TRANSISTOR |
| Q351 | 2SC3063 | TRANSISTOR |
| Q352 | 2SC3063 | TRANSISTOR |
| Q353 | 2SC3063 | TRANSISTOR |
| Q451 | JC501PQ | TRANSISTOR |
| Q452 | JC501PQ | TRANSISTOR |
| Q501 | 2SC4212H | TRANSISTOR |
| Q531 | JC501PQ | TRANSISTOR |
| Q541 | JC501PQ | TRANSISTOR |
| **Q551** | **BU2508DF** | **TRANSISTOR** |
| Q751 | 2SD637QRS | TRANSISTOR |
| | | CT-31G30TM CT-31G30UTM |
| Q752 | 2SB642QRS | TRANSISTOR |
| | | CT-31G30TM CT-31G30UTM |
| **Q753** | **2SD1266** | **TRANSISTOR** |
| | | **CT-31G30TM CT-31G30UTM** |
| Q2301 | JC501PQ | TRANSISTOR |
| Q2302 | JA101PQ | TRANSISTOR |
| Q2401 | MSD601R | TRANSISTOR |
| Q2402 | MSD601R | TRANSISTOR |
| Q3007 | MSB709-RTI | TRANSISTOR |
| Q3071 | MSD601R | TRANSISTOR |
| Q3072 | MSD601R | TRANSISTOR |
| Q3073 | MSD601R | TRANSISTOR |
| Q3201 | MSD601R | TRANSISTOR |
| Q3202 | MSD601R | TRANSISTOR |
| Q3203 | MSD601R | TRANSISTOR |
| Q3204 | MSD601R | TRANSISTOR |
| Q3205 | MSD601R | TRANSISTOR |
| Q3206 | MSD601R | TRANSISTOR |
| Q4351 | MSB709R | TRANSISTOR |
| Q4354 | MSB709R | TRANSISTOR |
| Q4355 | MSB709R | TRANSISTOR |
| Q4356 | MSB709R | TRANSISTOR |
| Q4357 | MSD601R | TRANSISTOR |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| Q4358 | MSB709R | TRANSISTOR |
| Q4360 | MSD601R | TRANSISTOR |
| Q4361 | MSD601R | TRANSISTOR |
| Q4362 | MSD601R | TRANSISTOR |
| Q4363 | MSD601R | TRANSISTOR |
| Q4366 | MSD601R | TRANSISTOR |
| Q4369 | MSB709R | TRANSISTOR |
| Q4370 | MSB709R | TRANSISTOR |
| Q4371 | MSD601R | TRANSISTOR |
| Q4401 | MSB709R | TRANSISTOR |
| | | **RELAYS** |
| **RL001** | **TSE1860–1** | **RELAY** |
| | | **RESISTORS** |
| R002 | ERD25TJ103 | RES,C 10K–J–1/4 |
| R003 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R004 | ERD25TJ331 | RES,C 330–J–1/4 |
| R005 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R006 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R007 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R008 | ERDS2TJ182 | RES,C 1.8K–J–1/4 |
| R009 | ERD25TJ101 | RES,C 100–J–1/4 |
| R013 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R017 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R018 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R019 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R020 | ERDS2TJ474 | RES,C 470K–J–1/4 |
| R021 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R022 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R023 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R024 | ERD25TJ101 | RES,C 100–J–1/4 |
| R025 | ERD25TJ101 | RES,C 100–J–1/4 |
| R026 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R030 | ERD25TJ683 | RES,C 68K–J–1/4 |
| R031 | ERDS2TJ823 | RES,C 82K–J–1/4 |
| R036 | ERD25TJ181 | RES,C 180–J–1/4 |
| R037 | ERDS2TJ752 | RES,C 7.5K–J–1/4 |
| R038 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R039 | ERDS2TJ333 | RES,C 33K–J–1/4 |
| R040 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R042 | ERDS2TJ203 | RES,C 20K–J–1/4 |
| R043 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R044 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R045 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R046 | ERDS2TJ182 | RES,C 1.8K–J–1/4 |
| R050 | EROS2TKF1002 | RES,M 10K–F–1/4<br>CT–31G30TM CT–31G30UTM |
| R050 | ER0S2CKF1002 | RES,M 10K–F–1/4<br>CT–27G30TM CT–27G30CTC<br>CT–27G30UTM |
| R054 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R055 | ERDS1FJ330 | RES,C 33–J–1/2 |
| R056 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R058 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R059 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R060 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R061 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R062 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R063 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R065 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R067 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R070 | ERDS1TJ183 | RES,C 18K–J–1/2 |
| R071 | ERD25TJ101 | RES,C 100–J–1/4 |
| R072 | ERD25TJ101 | RES,C 100–J–1/4 |
| R074 | ERDS1TJ183 | RES,C 18K–J–1/2 |
| R075 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R078 | ERG3ANJ103 | RES,M 1OK–J–3W |
| R080 | ERDS2TJ391 | RES,C 390–J–1/4 |
| R081 | ERDS2TJ122 | RES,C 1.2K–J–1/4 |
| R082 | ERD25TJ103 | RES,C 10K–J–1/4 |
| R083 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R084 | ERDS1TJ472 | RES,C 4.7K–J–1/2 |
| R085 | ERDS2TJ334 | RES,C 330K–J–1/4 |
| R086 | ERDS2TJ684 | RES,C 680K–J–1/4 |
| R088 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R089 | ERDS2TJ302 | RES,C 3K–J–1/4 |
| R091 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R092 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R093 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R094 | ERDS2TJ393 | RES,C 39K–J–1/4 |
| R102 | ERDS2TJ683 | RES,C 68K–J–1/4 |
| R103 | ERDS2TJ183 | RES,C 18K–J–1/4 |
| R104 | ERDS2TJ121 | RES,C 120–J–1/4 |
| R105 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R106 | EVND2AA03B14 | CONTROL 10K |
| R107 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R111 | ERDS2TJ361 | RES,C 360–J–1/4 |
| R112 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R113 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R114 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R115 | ERD25TJ221 | RES,C 220–J–1/4 |
| R152 | ERDS2TJ154 | RES,C 150K–J–1/4 |
| R201 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R202 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R203 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R204 | ERD25TJ472 | RES,C 4.7K–J–1/4 |
| R301 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R302 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R304 | ERDS2TJ274 | RES,C 270K–J–1/4 |
| R305 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R306 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R307 | ERD25TJ472 | RES,C 4.7K–J–1/4 |
| R313 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R317 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R319 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R324 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R325 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R326 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R327 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R328 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R332 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R339 | ERD25TJ514 | RES,C 510K–J–1/4 |
| R351 | ERG2ANJ123 | RES,M 12K–J–2W |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| R352 | ERG2ANJ123 | RES,M 12K–J–2W |
| R353 | ERG2ANJ123 | RES,M 12K–J–2W |
| R354 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R355 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R356 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R357 | ERDS2TJ241 | RES,C 240–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R357 | ERDS2TJ271 | RES,C 270–J–1/4 |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R358 | ERDS2TJ241 | RES,C 240–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R358 | ERDS2TJ271 | RES,C 270–J–1/4 |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R359 | ERDS2TJ241 | RES,C 240–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R359 | ERDS2TJ271 | RES,C 270–J–1/4 |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R360 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R361 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R362 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R364 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R365 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R366 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R401 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| R402 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R404 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R451 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R452 | ERD25TJ473 | RES,C 47K–J–1/4 |
| R453 | EVND2AA03B34 | CONTROL 30K |
| R454 | ERX1ANJ1R0 | RES,M 1.0–J–1W |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R454 | ERX1ANJ1R2 | RES,M 1.2–J–1W |
| | | CT–31G30TM CT–31G30UTM |
| R455 | ERDS2TJ333 | RES,C 33K–J–1/4 |
| R456 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R457 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R457 | ERDS2TJ681 | RES,C 680–J–1/4 |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R458 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R459 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R461 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R462 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R463 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| R464 | ERDS2TJ124 | RES,C 120K–J–1/4 |
| R465 | ERDS1FJ1R5 | RES,C 1.5–J–1/2 |
| R466 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R467 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R470 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R471 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R472 | ERDS2TJ103 | RES,C 10K–J–1/4 |

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| R501 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R502 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R503 | ERDS2TJ182 | RES,C 1.8K–J–1/4 |
| R504 | ERD25TJ561 | RES,C 560–J–1/4 |
| R505 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R506 | ERDS2TJ100 | RES,C 10–J–1/4 |
| R507 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R508 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R509 | ERG2ANJ562 | RES,M 5.6K–J–2W |
| **R510** | **ERG3ANJ242** | **RES,M 24K–J–3W** |
| | | **CT–31G30TM CT–31G30UTM** |
| **R510** | **ERG3ANJ392** | **RES,M 3.9K–J–3W** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **R511** | **ERG3ANJ242** | **RES,M 24K–J–3W** |
| | | **CT–31G30TM CT–31G30UTM** |
| **R511** | **ERG3ANJ332** | **RES,M 3.3K–J–3W** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| R516 | ERD25TJ681 | RES,C 680–J–1/4 |
| R517 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| **R531** | **ERD25FJ470** | **RES,C 47–J–1/4** |
| **R532** | **ER0S2CKF5362** | **RES,M 53.6K–F–1/4** |
| **R533** | **ER0S2CKF7151** | **RES,M 7.15K–F–1/4** |
| **R534** | **ERD25TJ684** | **RES,C 680K–J–1/4** |
| **R538** | **ERD25TJ821** | **RES,C 820–J–1/4** |
| **R539** | **ERDS2TJ681** | **RES,C 680–J–1/4** |
| R540 | ERD25TJ101 | RES,C 100–J–1/4 |
| R541 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R542 | ERDS2TJ121 | RES,C 120–J–1/4 |
| R544 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R546 | ERDS2TJ564 | RES,C 560K–J–1/4 |
| R547 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R548 | ERD25TJ394 | RES,C 390K–J–1/4 |
| R549 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R551 | ERX2ANJ1R0 | RES,M 1.0–J–2W |
| R552 | ERG2ANJ221 | RES,M 220–J–2W |
| R553 | ERD25TC0V | JUMPER |
| R554 | ERD25TJ623 | RES,C 62K–J–1/4 |
| R555 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R556 | ERDS2TJ202 | RES,C 2K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R556 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| R557 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| **R558** | **ERQ2CJP2R2** | **RES,F 2.2–J–2W** |
| **R559** | **ERG3SJ820** | **RES,M 82–J–3W** |
| R561 | ERG2ANJ102 | RES,M 1K–J–2W |
| R563 | ERG2ANJ561 | RES,M 560–J–2W |
| R571 | ERX1SJ1R0 | RES,M 1.0–J–1W |
| R572 | ERG3SJ390 | RES,M 39–J–3W |
| R601 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R602 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R604 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R605 | ERDS2TJ331 | RES,C 330–J–1/4 |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| R606 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R607 | ERD25TJ202 | RES,C 2K–J–1/4 |
| R608 | ERD25TJ202 | RES,C 2K–J–1/4 |
| R609 | ERD25TJ202 | RES,C 2K–J–1/4 |
| R610 | ERD25TJ182 | RES,C 1.8K–J–1/4 |
| R611 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R612 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R613 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R614 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R615 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R616 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R617 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R618 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R619 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R752 | ERDS2TJ333 | RES,C 33K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R753 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R754 | ERQ14AJ221 | RES,F 220–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R755 | ERDS2TJ563 | RES,C 56K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R756 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R757 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R758 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R759 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R760 | EVND8AA03B53 | CONTROL 5K |
| | | CT–31G30TM CT–31G30UTM |
| R761 | EVND8AA03B14 | CONTROL 10K |
| | | CT–31G30TM CT–31G30UTM |
| R762 | ERDS2TJ182 | RES,C 1.8K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R763 | ERDS2TJ183 | RES,C 18K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R764 | ERDS2TJ124 | RES,C 120K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R765 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R766 | ERDS2TJ362 | RES,C 3.6K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R767 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| | | CT–31G30TM CT–31G30UTM |
| R768 | ERQ2CJP100 | RES,F 10–J–2W |
| | | CT–31G30TM CT–31G30UTM |
| **R801** | **ERF7ZKR82** | **RES,W .82–K–7W** |
| **R802** | **ERC12ZGM825** | **RES,S 8.2MEG–M–1/2** |
| R804 | ERG2ANJ333 | RES,M 33K–J–2W |
| R805 | ERF2AKR27 | RES,W .27–K–2W |
| R806 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R807 | ERDS1FJ132 | RES,C 1.3K–J–1/2 |
| R808 | ERDS2TJ185 | RES,C 1.8MEG–J–1/4 |
| R809 | ERDS1TJ101 | RES,C 100–J–1/2 |

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| **R810** | **ERDS1FJ1R0** | **RES,C 1.0–J–1/2** |
| **R811** | **ERQ1CKPR33** | **RES,F .33–K–1W** |
| R812 | ERQ2CKP1R2 | RES,F 1.2–K–2W |
| **R813** | **ERQ2CKR33** | **RES,F .33–K–2W** |
| R814 | ERDS2TJ185 | RES,C 1.8MEG–J–1/4 |
| R816 | ERDS2TJ105 | RES,C 1MEG–J–1/4 |
| R1023 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R1025 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R1029 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R1030 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R1801 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R1802 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R1803 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R1804 | ERJ6GEYJ562 | RES,M 5.6K–J–1/10 |
| R1805 | ERJ6GEYJ562 | RES,M 5.6K–J–1/10 |
| R1806 | ERJ6GEYJ750 | RES,M 75–J–1/10 |
| R1807 | ERJ6GEYJ750 | RES,M 75–J–1/10 |
| R1811 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R1812 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R1813 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R1814 | EVND8AA03B23 | CONTROL 2K |
| R1815 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R1816 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R1817 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R1818 | ERJ6GEYJ562 | RES,M 5.6K–J–1/10 |
| R1819 | ERJ6GEYJ153 | RES,M 15K–J–1/10 |
| R1821 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1822 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1823 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1824 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1825 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1826 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1827 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1828 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1830 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1831 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1832 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R1833 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R2132 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R2133 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R2134 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R2135 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R2201 | ERJ6GEYJ512 | RES,M 5.1K–J–1/10 |
| R2202 | ERJ6GEYJ112 | RES,M 1.1K–J–1/10 |
| R2203 | ERJ6ENF5602 | RES,M 56K–F–1/10 |
| R2204 | ERJ6GEYJ562 | RES,M 5.6K–J–1/10 |
| R2205 | ERJ6GEYJ153 | RES,M 15K–J–1/10 |
| R2206 | ERJ6GEYJ823 | RES,M 82K–J–1/10 |
| R2207 | ERJ6GEYJ153 | RES,M 15K–J–1/10 |
| R2208 | ERJ6GEYJ154 | RES,M 150K–J–1/10 |
| R2209 | EVND8AA03B54 | CONTROL 50K |
| R2210 | ERJ6GEYJ134 | RES,M 130K–J–1/10 |
| R2211 | ERJ6GEYJ154 | RES,M 150K–J–1/10 |
| R2212 | ERJ6GEYJ302 | RES,M 3K–J–1/10 |
| R2213 | EVND8AA03B54 | CONTROL 50K |
| R2219 | ERJ6GEYJ153 | RES,M 15K–J–1/10 |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| R2220 | EVND8AA03B24 | CONTROL 20K |
| R2221 | EVND8AA03B34 | CONTROL 30K |
| R2222 | ERJ6GEYJ153 | RES,M 15K–J–1/10 |
| R2223 | ERJ6GEYJ393 | RES,M 39K–J–1/10 |
| R2226 | ERJ6GEYJ474 | RES,M 470K–J–1/10 |
| R2228 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R2245 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R2277 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R2301 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2302 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2303 | ERDS2TJ912 | RES,C 9.1K–J–1/4 |
| R2304 | ERDS2TJ912 | RES,C 9.1K–J–1/4 |
| R2305 | ERD25FJ2R2 | RES,C 2.2–J–1/4 |
| R2306 | ERD25FJ2R2 | RES,C 2.2–J–1/4 |
| R2307 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R2308 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R2310 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2311 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2312 | ERJ6GEYJ184 | RES,M 180K–J–1/10 |
| R2313 | ERJ6GEYJ563 | RES,M 56K–J–1/10 |
| R2315 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R2316 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R2317 | ERJ6GEYJ184 | RES,M 180K–J–1/10 |
| R2340 | ERJ6GEYJ332 | RES,M 3.3K–J–1/10 |
| R2342 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R2345 | ERJ6GEYJ472 | RES,M 4.7K–J–1/10 |
| R2346 | ERJ6GEYJ332 | RES,M 3.3K–J–1/10 |
| R2348 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R2349 | ERJ6GEYJ472 | RES,M 4.7K–J–1/10 |
| R2350 | ERJ6GEYJ332 | RES,M 3.3K–J–1/10 |
| R2351 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R2352 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R2353 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R2354 | ERJ6GEYJ681 | RES,M 680–J–1/10 |
| R2401 | ERJ6GEYJ392 | RES,M 3.9K–J–1/10 |
| R2402 | ERJ6GEYJ392 | RES,M 3.9K–J–1/10 |
| R2403 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R2404 | ERJ6GEYJ133 | RES,M 13K–J–1/10 |
| R2405 | ERJ6GEYJ824 | RES,M 820K–J–1/10 |
| R2406 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R2407 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2410 | ERD25FJ3R9 | RES,C 3.9–J–1/4 |
| R2411 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2412 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R2415 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R2416 | ERJ6GEYJ104 | RES,M 100K–J–1/10 |
| R2451 | ERJ6GEYJ225 | RES,M 2.2MEG–J–1/10 |
| R2454 | ERJ6GEYJ243 | RES,M 24K–J–1/10 |
| R2455 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3001 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3002 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3003 | ERDS2TJ184 | RES,C 180K–J–1/4 |
| R3004 | ERDS2TJ184 | RES,C 180K–J–1/4 |
| R3005 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R3006 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3007 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R3008 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3009 | ERDS2TJ122 | RES,C 1.2K–J–1/4 |
| R3010 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3011 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R3012 | ERDS2TJ683 | RES,C 68K–J–1/4 |
| R3014 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3015 | ERJ6GEYJ104 | RES,M 100K–J–1/10 |
| R3016 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R3017 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3026 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3031 | ERDS2TJ121 | RES,C 120–J–1/4 |
| R3032 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3033 | ERDS2TJ184 | RES,C 180K–J–1/4 |
| R3034 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3035 | ERDS2TJ184 | RES,C 180K–J–1/4 |
| R3036 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3037 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R3038 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R3071 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R3072 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R3073 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R3074 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R3075 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3076 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3077 | ERJ6GEYJ152 | RES,M 1.5K–J–1/10 |
| R3078 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R3201 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3202 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R3203 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R3204 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3205 | ERJ6GEYJ272 | RES,M 2.7K–J–1/10 |
| R3206 | ERJ6GEYJ682 | RES,M 6.8K–J–1/10 |
| R3207 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3208 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3209 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3210 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R3211 | ERJ6GEYJ181 | RES,M 180–J–1/10 |
| R3212 | ERJ6GEYJ331 | RES,M 330–J–1/10 |
| R3213 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3214 | ERJ6GEYJ331 | RES,M 330–J–1/10 |
| R3215 | EVND8AA03B22 | CONTROL 200 OHM |
| R3217 | ERJ6GEYJ271 | RES,M 270–J–1/10 |
| R3218 | ERJ6GEYJ122 | RES,M 1.2K–J–1/10 |
| R3220 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R3221 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R3222 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R3223 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R3224 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R3227 | ERJ6GEYJ332 | RES,M 3.3K–J–1/10 |
| R3228 | ERJ6GEYJ104 | RES,M 100K–J–1/10 |
| R3229 | ERJ6GEYJ152 | RES,M 1.5K–J–1/10 |
| R4356 | ERJ6GEYJ561 | RES,M 560–J–1/10 |
| R4358 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R4359 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4360 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R4361 | ERJ6GEYJ560 | RES,M 56–J–1/10 |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| R4362 | ERJ6GEYJ561 | RES,M 560–J–1/10 |
| R4363 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4364 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R4365 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R4367 | ERJ6GEYJ331 | RES,M 330–J–1/10 |
| R4368 | ERJ6GEYJ510 | RES,M 51–J–1/10 |
| R4369 | ERJ6GEYJ105 | RES,M 1.0MEG–J–1/10 |
| R4370 | ERJ6GEYJ222 | RES,M 2.2K–J–1/10 |
| R4371 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R4372 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4373 | ERJ6GEYJ822 | RES,M 8.2K–J–1/10 |
| R4374 | ERJ6GEYJ273 | RES,M 27K–J–1/10 |
| R4375 | ERJ6GEYJ221 | RES,M 220–J–1/10 |
| R4376 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4377 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R4378 | ERJ6GEYJ562 | RES,M 5.6K–J–1/10 |
| R4379 | ERJ6GEYJ103 | RES,M 10K–J–1/10 |
| R4380 | ERJ6GEYJ683 | RES,M 68K–J–1/10 |
| R4381 | ERJ6GEYJ331 | RES,M 330–J–1/10 |
| R4382 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4383 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4384 | ERJ6GEYJ331 | RES,M 330–J–1/10 |
| R4392 | ERJ6GEYJ332 | RES,M 3.3K–J–1/10 |
| R4395 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| R4396 | ERJ6GEYJ471 | RES,M 470–J–1/10 |
| R4397 | ERJ6GEYJ393 | RES,M 39K–J–1/10 |
| R4398 | ERJ6GEYJ334 | RES,M 330K–J–1/10 |
| R4399 | ERJ6GEYJ272 | RES,M 2.7K–J–1/10 |
| R4411 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4413 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4414 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4415 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4417 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4418 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4419 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4423 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R4424 | ERJ6GEYJ473 | RES,M 47K–J–1/10 |
| R4426 | ERJ6GEYJ561 | RES,M 560–J–1/10 |
| R4427 | ERJ6GEYJ223 | RES,M 22K–J–1/10 |
| R4428 | ERJ6GEYJ222 | RES,M 2.2K–J–1/10 |
| R4441 | ERJ6GEYJ101 | RES,M 100–J–1/10 |
| R4442 | ERJ6GEYJ102 | RES,M 1K–J–1/10 |
| | | **SWITCHES** |
| S001 | EVQQBH06T | SWITCH, PUSH |
| S002 | EVQQBH06T | SWITCH, PUSH |
| S003 | EVQQBH06T | SWITCH, PUSH |
| S004 | EVQQBH06T | SWITCH, PUSH |
| S005 | EVQQBH06T | SWITCH, PUSH |
| S006 | EVQQBH06T | SWITCH, PUSH |
| S007 | EVQQBH06T | SWITCH, PUSH |
| | | **TRANSFORMERS** |
| **T001** | **TLP16297** | **TRANSFORMER, POWER SUPPLY** |
| **T501** | **TLH15452** | **TRANSFORMER, HORIZONTAL DRIVER** |
| **T551** | **0LF04508F** | **TRANSFORMER, FLYBACK** |
| **T801** | **ETS39AG115AC** | **TRANSFORMER, POWER** |

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | | **CRYSTALS/FILTERS** |
| X001 | TSS2080MX | CRYSTAL, 12 MHZ CLOCK |
| X101 | EFCH45MVK12N | SAW FILTER |
| X102 | EFCWS4504AB | FILTER, CERAP |
| X201 | EFCS4R5MS4W | FILTER 4.5MHZ BANDPASS |
| X501 | EF0A503KS41 | CRYSTAL, 503KHZ OSCILLATOR |
| X601 | TS816M32 | CRYSTAL 3.58MHZ OSCILLATOR |
| X4351 | TSS2163–M | CRYSTAL, 14.3MHZ OSCILLATOR |
| | | **OTHERS** |
| RM001 | RPM–637CBRS | RECEIVER, REMOTE CONTROL |
| TNR001 | ENV568N6G3 | TUNER |
| TNR002 | ENG26205G | U/V TUNER |
| M001 | ENPE620 | ANTENNA UNIT |
| M002 | EUR501232 | TRANSMITTER |
| **M003** | **M68LGL061X** | **CRT 27"** |
| | | **CT–27G30TM CT–27G30CTC** |
| | | **CT–27G30UTM** |
| **M004** | **M78JUA069X** | **CRT** |
| | | **CT–31G30TM CT–31G30UTM** |
| M005 | TBM2A10141 | PANASONIC BADGE |
| M006 | TBX2A50251 | ASSY, 7 PUSHBUTTON |
| M007 | TES2A20312 | SPRING, DAG GROUND |
| **M008** | **TJS1A5050** | **CRT SOCKET** |
| M009 | TKP2A11221 | SMOKED PANEL |
| M010 | TKY2A3062C | CABT. FRONT 27" |
| | | CT–27G30CTC |
| M011 | TLC2047–2 | MAGNET,RINGS:PURITY & STATIC CONV. |
| M012 | TMW2A97121 | STRAIN RELIEF: AC LINE CORD |
| M013 | TQB2A0943–1 | OWNERS MANUAL |
| | | CT–27G30TM CT–31G30TM |
| | | CT–27G30UTM CT–31G30UTM |
| M014 | TQB2A0971 | OWNERS MANUAL |
| | | CT–27G30CTC |
| **M015** | **TSX3134X** | **AC LINE CORD** |
| M016 | TXFKU0395SER | ASSY, CABINET BACK |
| | | CT–27G30TM CT–27G30UTM |
| M017 | TXFKY4694SER | ASSY, CABINET FRONT |
| | | CT–27G30TM CT–27G30UTM |
| M018 | TXFKU4194SER | ASSY, CABINET BACK |
| | | CT–27G30CTC |
| M019 | TXFKU0495SER | ASSY, CABINET BACK |
| | | CT–31G30TM CT–31G30UTM |
| M020 | TXFKY4794SER | ASSY, CABINET FRONT |
| | | CT–31G30TM CT–31G30UTM |
| M021 | TXFMK01H55 | CONVERGENCE CORRECTOR STRIP |
| | | CT–27G30CTC |
| M022 | TXF3A01ADR | ASSY, DAG GROUND |
| | | CT–27G30TM CT–27G30CTC |
| | | CT–27G30UTM |
| M023 | TXF3A01AFR | ASSY, DAG GROUND |
| | | CT–31G30TM CT–31G30UTM |
| M024 | 0FMK014ZZ | CONVERGENCE CORRECTOR STRIP |
| | | CT–27G30TM CT–31G30TM |
| | | CT–27G30UTM CT–31G30UTM |
| JK3031 | TJB18619 | AV TERMINAL (2AV VAO) |

# REPLACEMENT PARTS LIST

**(Models: CT–27G30T, CT–31G30T, CT–27G30C, CT–27G30UT, CT–31G30UT)**

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| REF. NO. | PART NO. | DESCRIPTION | REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|---|---|---|
| M025 | T8A262 | SILICONE GREASE – HEAT SINK COMPOUND | | | |

DESCRIPTION OF ABBREVIATIONS GUIDE

| RESISTOR | | | |
|---|---|---|---|
| TYPE | | TOLERANCE | |
| C | Carbon | F | +/– 1% |
| F | Fuse | J | +/– 5% |
| M | Metal Oxide | K | +/– 10% |
| S | Solid | M | +/– 20% |
| W | Wire Wound | G | +/– 2% |

RES, C 270–J–1/4

| CAPACITOR | | | |
|---|---|---|---|
| TYPE | | TOLERANCE | |
| C | Ceramic | C | +/– 0.25pF |
| E | Electrolytic | D | +/– 0.5pF |
| P | Polyester | F | +/– 1pF |
| S | Styrol | J | +/– 5% |
| T | Tantalum | K | +/– 10% |
| | | L | +/– 15% |
| | | M | +/– 20% |
| | | P | +100% –0% |
| | | Z | +80% –20% |

CAP, P .068UF–K–50V

# NOTES

# NOTES

# NOTES

# NOTES

"MIN".

4. All video and color waveforms taken with a wideband scope and a probe with low capacity (10 to 1). Shape and peak amplitudes may vary depending on type of Oscilloscope used and calibration.

COLOR – Waveforms 4~8
VERTICAL – Waveforms 9~12
HORIZONTAL – Waveforms 13~16
CRT DRIVE – Waveforms 17 & 18
POWER SUPPLY – Waveform 19 ~ 21

## Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in μH.
4. Test point indicated by ●, Test point but no pin ⚲.
5. Components indicated with ⚠ symbol are critical parts and replacement should be made with manufacture specified replacement parts only.
6. **— (BOLD LINES)** Indicates the route of B+ supply.
7. This schematic diagram is the latest at the time of printing and subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION** and ⫻ indicates COLD GROUND CONNECTION.

**NOTE:** All other component symbols are used for design engineering purposes.

## Voltage Measurements

1. Voltage measurement:
   - AC input to Receiver is 120V. NTSC generator connected to antenna of Receiver. (color bar pattern of 100IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments set for Normalize.

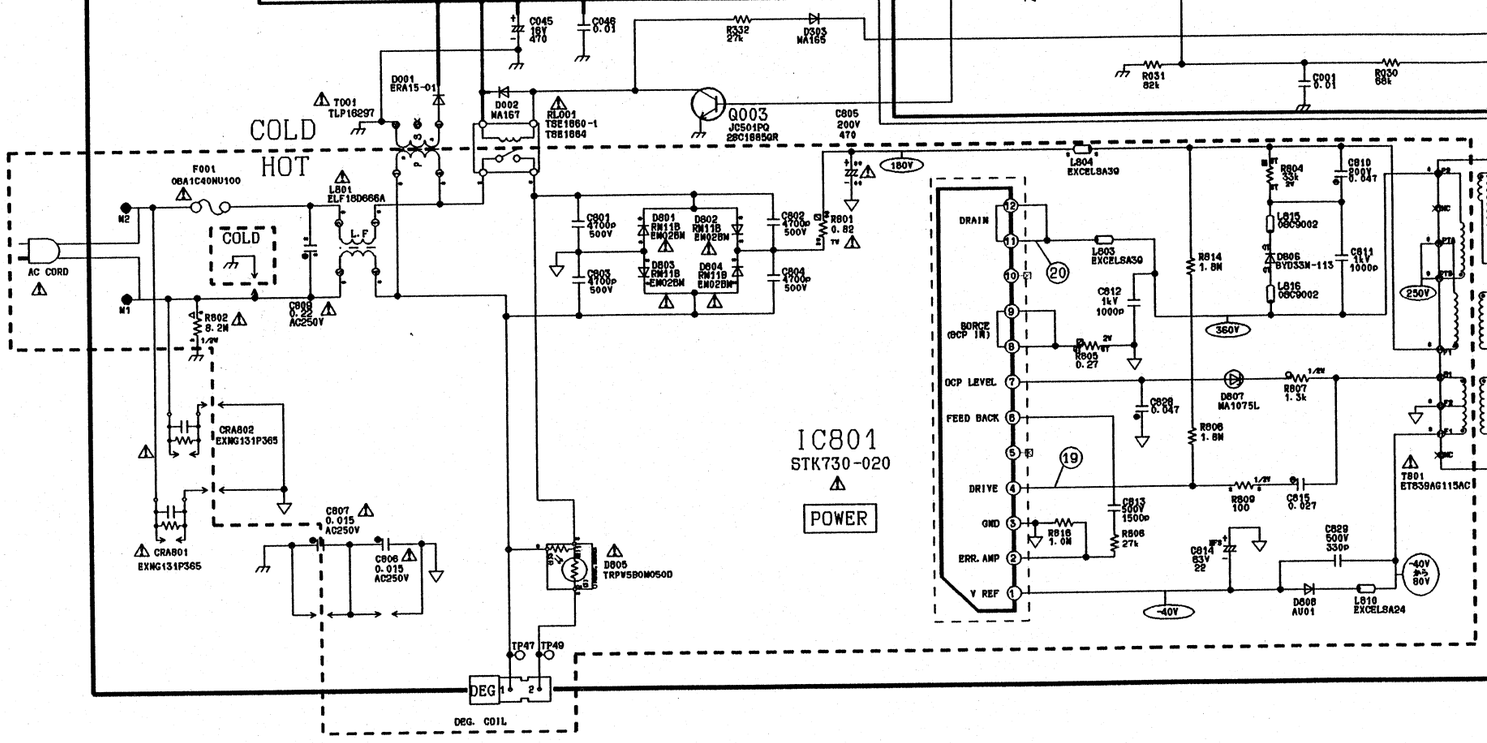
     TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode

     Volume – Min

     TV/Video SW – TV position

     Audio Mode – Stereo
   - Voltage readings are nominal and may vary ±10% on active devices.

     Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**




## Note: Stereo Models

The Functions listed below are activated by a DC voltage change to DAC Inputs ( Pin 18 and 19 ) of MPU IC001. Press and hold a function button on Receiver to take voltage readings.

| FUNCTION | PIN 18 | PIN 19 |
|---|---|---|
| POWER | 0V~0.6V | 0V(Set "OFF") |
| | | 0.7V~3.0V (Set "ON") |
| VOL ◀ | 0.7V~1.2V | 0.7V~3.0V |
| VOL ▶ | 1.3V~1.8V | 0.7V~3.0V |
| CH ▼ | 1.9V~2.4V | 0.7V~3.0V |
| CH ▲ | 2.6V~3.0V | 0.7V~3.0V |
| TV/VIDEO | 3.2V~3.7V | 0.7V~3.0V |
| ACTION | 4.6V~5.0V | 0V~0.6V |

The AUDIO MODES being broadcast are displayed on screen in red by the voltage change to DAC input (Pin 20) of MPU IC001.

| AUDIO MODE BROADCAST | PIN 20 |
|---|---|
| MONO | 4.0V~5.0V |
| SAP | 2.3V~4.0V |
| STEREO | 1.0V~2.0V |
| STEREO & SAP | 0V~0.9V |

## Voltage Chart – A–Board (27" Models)

### Integrated Circuits (ICs)

**IC001**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 5.1 | 23 | 0.1 | 45 | 2.6 |
| 2 | 3.7 | 24 | 4.5 | 46 | 0 |
| 3 | 3.9 | 25 | 2.6 | 47 | 0 |
| 4 | 5.1 | 26 | 0 | 48 | 0 |
| 5 | 0 | 27 | 4.6 | 49 | 0 |
| 6 | 5.0 | 28 | 4.5 | 50 | 5.1 |
| 7 | 5.1 | 29 | 0 | 51 | 4.9 |
| 8 | 5.1 | 30 | 0 | 52 | 0 |
| 9 | 5.1 | 31 | 4.3 | | |
| 10 | 0 | 32 | 3.8 | | |
| 11 | 0 | 33 | 0 | | |
| 12 | 0 | 34 | 0 | | |
| 13 | 3.1 | 35 | 0 | | |
| 14 | 2.7 | 36 | 0 | | |
| 15 | 3.0 | 37 | 2.3 | | |
| 16 | 0.9 | 38 | 0 | | |
| 17 | 0 | 39 | 1.6 | | |
| 18 | 5.2 | 40 | 1.5 | | |
| 19 | 1.9 | 41 | 5.2 | | |
| 20 | 4.2 | 42 | 5.2 | | |
| 21 | 2.0 | 43 | 5.2 | | |
| 22 | 4.1 | 44 | 2.6 | | |

**IC002**

| | |
|---|---|
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 4.5 |
| 6 | 4.5 |
| 7 | 0 |
| 8 | 5.1 |

**IC101**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2.5 | 23 | 4.3 | 45 | 6.2 |
| 2 | 1.7 | 24 | 2.7 | 46 | 2.6 |
| 3 | 3.7 | 25 | 4.6 | 47 | 4.2 |
| 4 | 0 | 26 | 4.0 | 48 | 2.1 |
| 5 | 0 | 27 | 2.4 | 49 | 2.7 |
| 6 | 0 | 28 | 0 | 50 | 0.8 |
| 7 | 0 | 29 | 2.7 | 51 | 5.8 |
| 8 | 5.2 | 30 | 8.2 | 52 | 4.1 |
| 9 | 2.5 | 31 | 4.6 | | |
| 10 | 2.5 | 32 | 2.9 | | |
| 11 | 2.5 | 33 | 2.4 | | |
| 12 | 8.2 | 34 | 2.8 | | |
| 13 | 2.4 | 35 | 1.8 | | |
| 14 | 5.8 | 36 | 3.0 | | |
| 15 | 4.9 | 37 | 3.0 | | |
| 16 | 4.9 | 38 | 5.0 | | |
| 17 | 5.0 | 39 | 3.5 | | |
| 18 | 2.9 | 40 | 2.6 | | |
| 19 | 3.0 | 41 | 0 | | |
| 20 | 0 | 42 | 2.5 | | |
| 21 | 0 | 43 | 2.0 | | |
| 22 | 2.6 | 44 | 0.3 | | |

**IC451**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 4.1 |
| 3 | 6.2 |
| 4 | 0 |
| 5 | 6.5 |
| 6 | 5.3 |
| 7 | 26.0 |
| 8 | 2.4 |
| 9 | 1.1 |
| 10 | 0 |
| 11 | 15.0 |
| 12 | 26.6 |
| 13 | 5.3 |

**IC551**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 0 |
| 3 | 8.8 |

**IC552**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 0 |
| 3 | 5.0 |

**IC553**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 12.0 |
| 3 | 0 |

**IC801** ⏚

| | |
|---|---|
| 1 | – 39.5 |
| 2 | – 32.8 |
| 3 | 0 |
| 4 | – 0.1 |
| 5 | 1.7 |
| 6 | 1.5 |
| 7 | – 0.3 |
| 8 | 0.3 |
| 9 | 0.3 |
| 10 | NC |
| 11 | VARIES 141~154 |
| 12 | VARIES 141~154 |

**IC2301**

| | |
|---|---|
| 1 | 1.2 |
| 2 | 0 |
| 3 | 18.1 |
| 4 | 0 |
| 5 | 0 |
| 6 | 1.2 |
| 7 | 9.7 |
| 8 | 17.2 |
| 9 | 0 |
| 10 | 18.3 |
| 11 | 17.2 |
| 12 | 9.4 |

### Transistors

| Ref. | b | c | e |
|---|---|---|---|
| Q002 | 5.9 | 11.7 | 5.3 |
| Q003 | .7 | 0 | 0 |
| Q004 | 4.9 | 5.7 | 5.8 |
| Q007 | 0.6 | 0 | 0 |
| Q008 | 1.6 | 5.2 | 1.6 |
| Q015 | 5.2 | 0 | 5.0 |
| Q101 | 0 | 2.8 | 0 |
| Q103 | 2.8 | 8.1 | 2.2 |
| Q305 | 1.3 | 0 | 2.0 |
| Q306 | 4.6 | 8.2 | 4.0 |
| Q307 | 3.9 | 8.2 | 3.3 |
| Q451 | 0 | 2.4 | 0 |
| Q452 | 0.2 | 0.1 | 0 |
| Q501 | 0.3 | 99.6 | 0 |
| Q531 | 10.6 | 16.4 | 10.2 |
| Q541 | 0 | 3.8 | 0 |
| Q551 | 0.1 | 137.4 | 0 |
| Q753 | 0.5 | 9.4 | 0 |
| Q2301 | 0 | 18.1 | 0 |
| Q2302 | 18.1 | 0 | 18.1 |

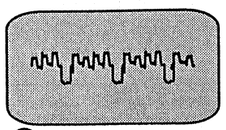
Enable, Data

**NOTE:** Volta
chan

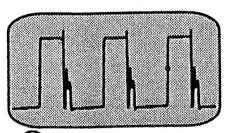
| – V |
|---|
| Ch. 02 |
| Ch. 06 |
| Ch. 07 |
| Ch. 13 |

# Waveforms – A–Schematic (27" Models)

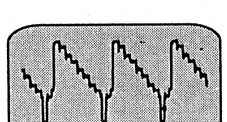
1 0.78V p–p [20µs]



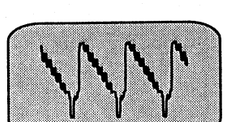
8 3.6V p–p [20µs]



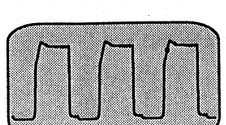
15 2.5V p–p [20µs]



2 0.73V p–p [20µs]

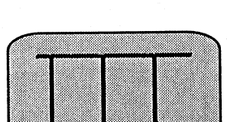


9 1.2V p–p [20µs]

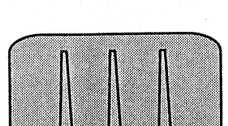


16 200V p–p [20µs]

3 0.45V p–p [20µs]

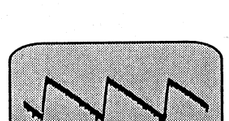


10 4.6V p–p [5ms]

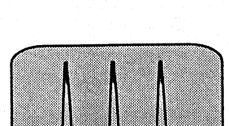


17 254V p–p [20µs]

4 0.2V p–p [20µs]

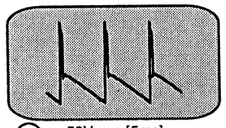


11 3V p–p [5ms]

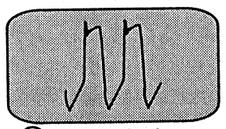


18 29.2V p–p [20µs]

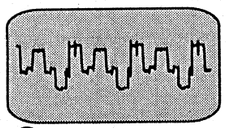
5 0.4V p–p [1µs]



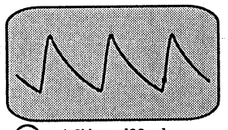
12 56V p–p [5ms]



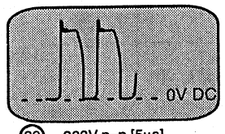
19 14V p–p [5µs]



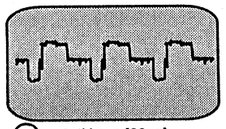
6 4.0V p–p [20µs]



13 1.6V p–p [20µs]




20 292V p–p [5µs]



7 3.4V p–p [20µs]

14 0.8V p–p [5µs]

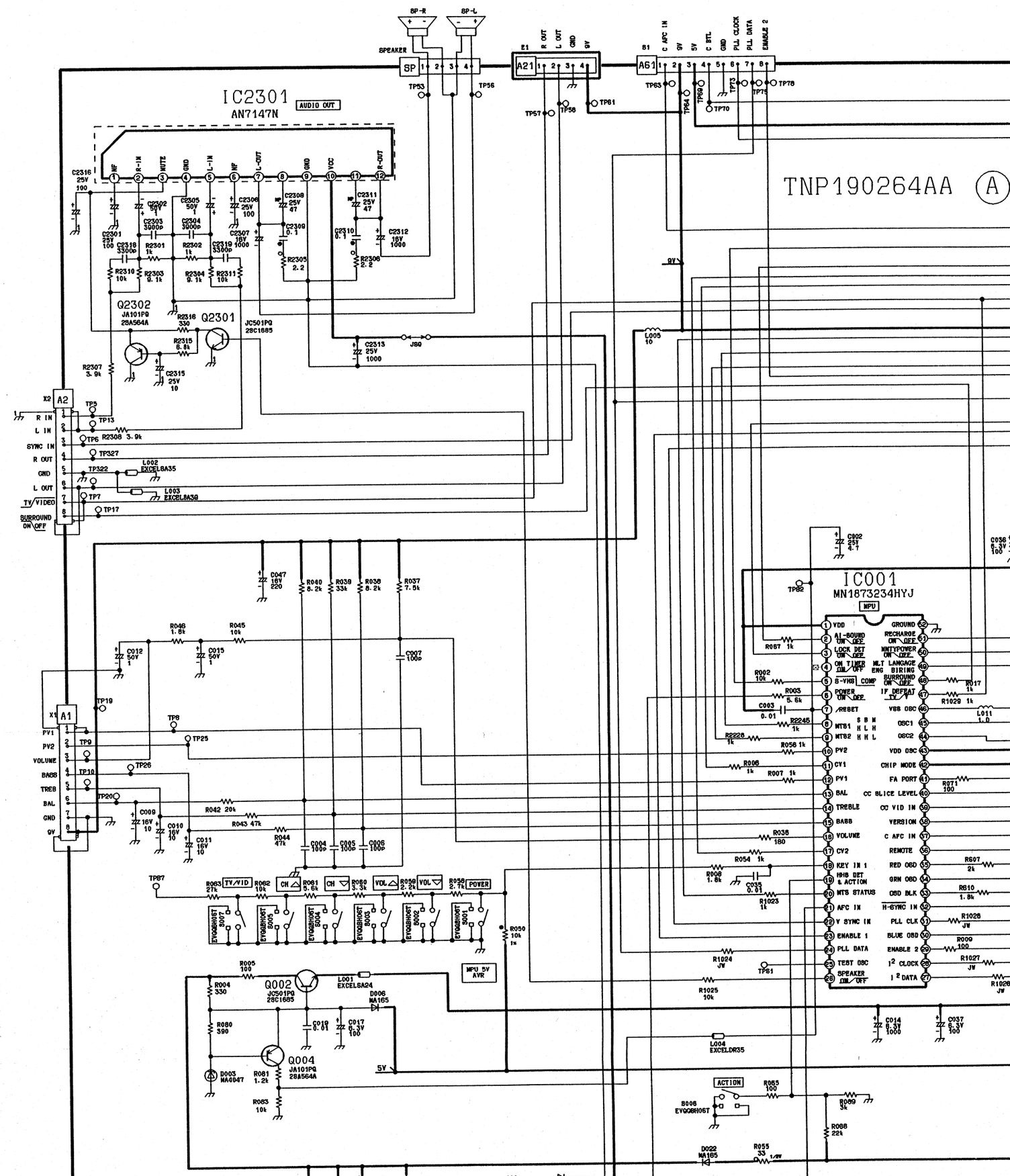
## Waveform Measurements

1. (3) indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken in Service Mode 1.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.

   **CAUTION:** Incorrect ground connection of test equipment will result in erroneous readings.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1~3
COLOR – Waveforms 4~8
VERTICAL – Waveforms 9~12




# Waveform Measurements

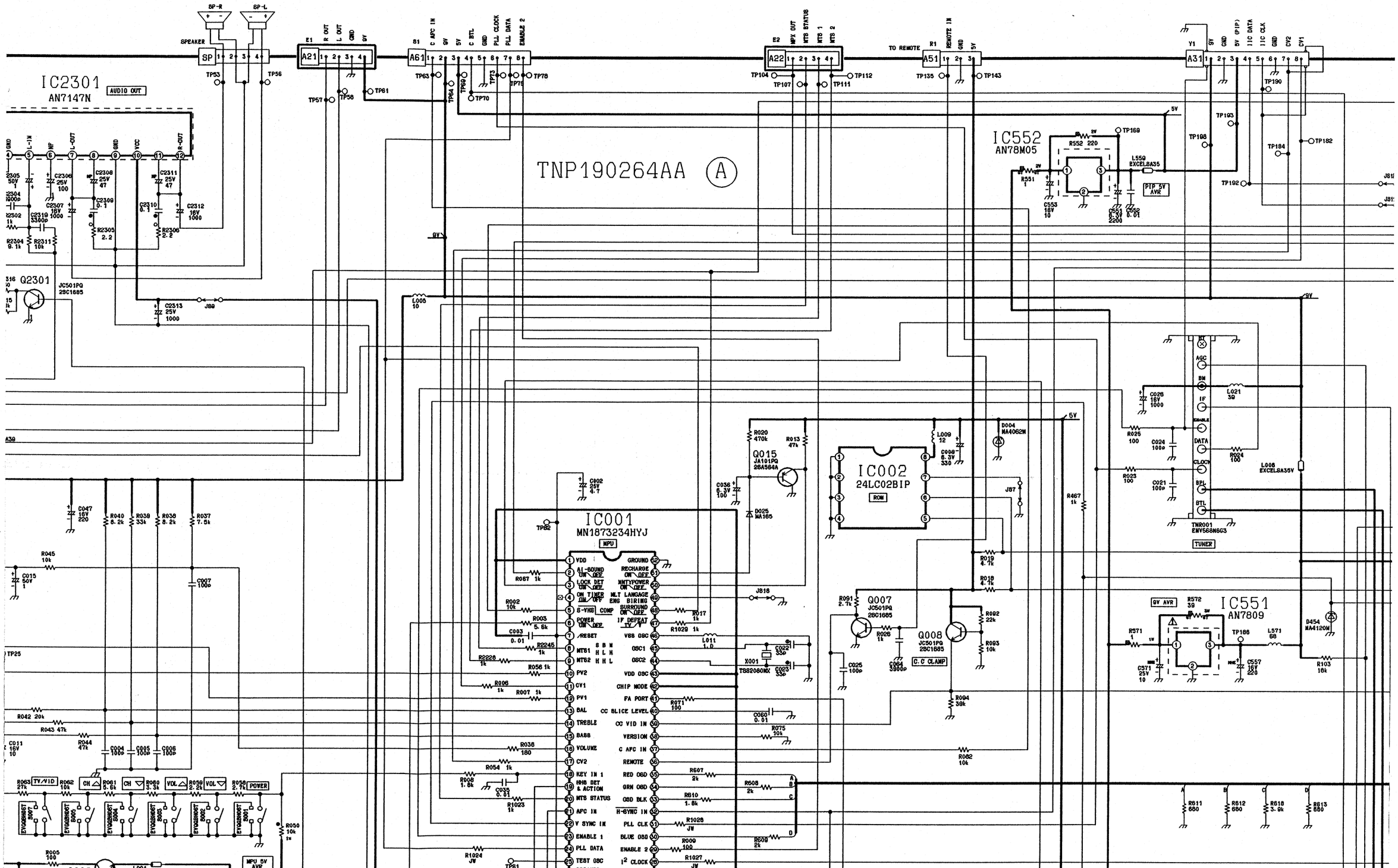
1. (3) indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken in Service Mode 1.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.

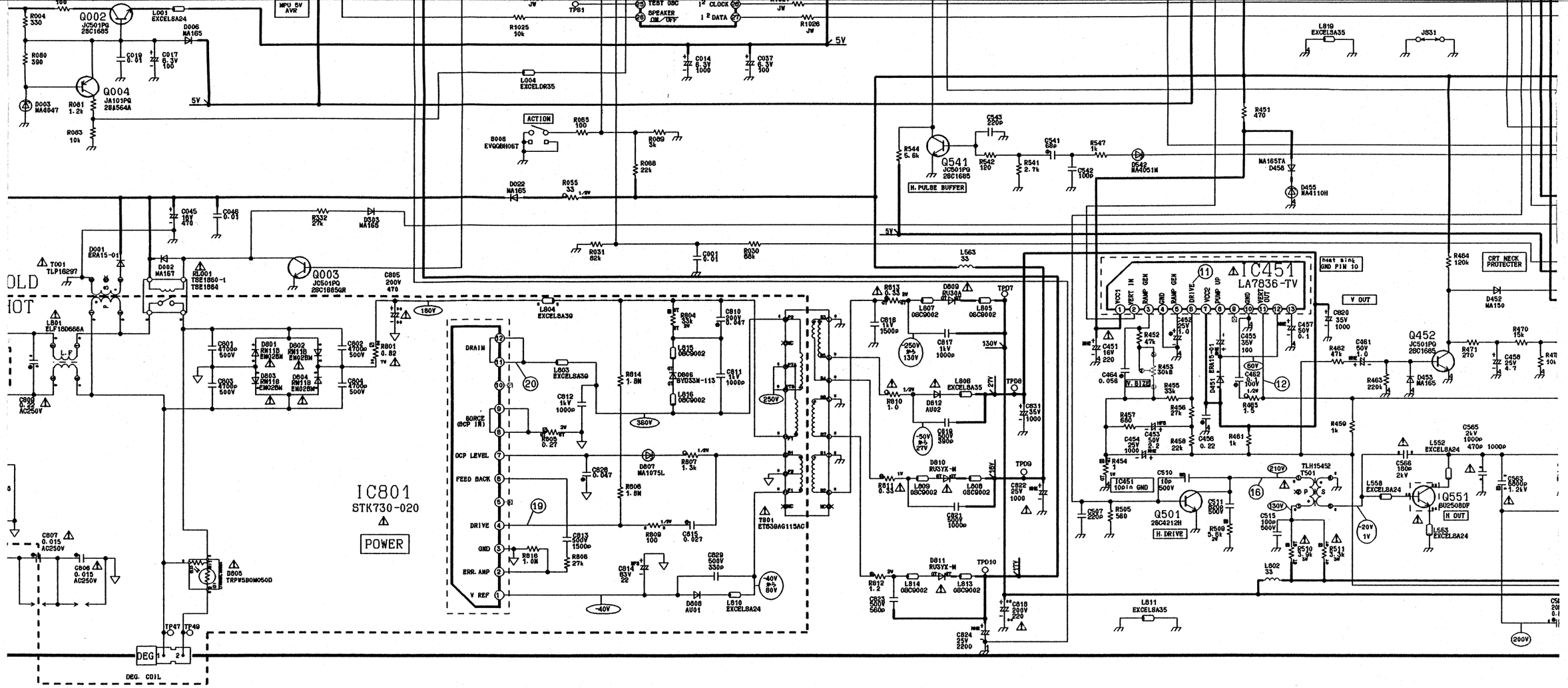
   **CAUTION:** Incorrect ground connection of test equipment will result in erroneous readings.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1~3
COLOR – Waveforms 4~8
VERTICAL – Waveforms 9~12

# A–Board Schematic (27” Models)






## art – A–Board (27" Models)

### Cs)

**IC101**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2.5 | 23 | 4.3 | 45 | 6.2 |
| 2 | 1.7 | 24 | 2.7 | 46 | 2.6 |
| 3 | 3.7 | 25 | 4.6 | 47 | 4.2 |
| 4 | 0 | 26 | 4.0 | 48 | 2.1 |
| 5 | 0 | 27 | 2.4 | 49 | 2.7 |
| 6 | 0 | 28 | 0 | 50 | 0.8 |
| 7 | 0 | 29 | 2.7 | 51 | 5.8 |
| 8 | 5.2 | 30 | 8.2 | 52 | 4.1 |
| 9 | 2.5 | 31 | 4.6 | | |
| 10 | 2.5 | 32 | 2.9 | | |
| 11 | 2.5 | 33 | 2.4 | | |
| 12 | 8.2 | 34 | 2.8 | | |
| 13 | 2.4 | 35 | 1.8 | | |
| 14 | 5.8 | 36 | 3.0 | | |
| 15 | 4.9 | 37 | 3.0 | | |
| 16 | 4.9 | 38 | 5.0 | | |
| 17 | 5.0 | 39 | 3.5 | | |
| 18 | 2.9 | 40 | 2.6 | | |
| 19 | 3.0 | 41 | 0 | | |
| 20 | 0 | 42 | 2.5 | | |
| 21 | 0 | 43 | 2.0 | | |
| 22 | 2.6 | 44 | 0.3 | | |

**IC451**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 4.1 |
| 3 | 6.2 |
| 4 | 0 |
| 5 | 6.5 |
| 6 | 5.3 |
| 7 | 26.0 |
| 8 | 2.4 |
| 9 | 1.1 |
| 10 | 0 |
| 11 | 15.0 |
| 12 | 26.6 |
| 13 | 5.3 |

**IC551**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 0 |
| 3 | 8.8 |

**IC552**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 0 |
| 3 | 5.0 |

**IC553**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 12.0 |
| 3 | 0 |

**IC801** ⏚

| | |
|---|---|
| 1 | – 39.5 |
| 2 | – 32.8 |
| 3 | 0 |
| 4 | – 0.1 |
| 5 | 1.7 |
| 6 | 1.5 |
| 7 | – 0.3 |
| 8 | 0.3 |
| 9 | 0.3 |
| 10 | NC |
| 11 | VARIES 141~154 |
| 12 | VARIES 141~154 |

**IC2301**

| | |
|---|---|
| 1 | 1.2 |
| 2 | 0 |
| 3 | 18.1 |
| 4 | 0 |
| 5 | 0 |
| 6 | 1.2 |
| 7 | 9.7 |
| 8 | 17.2 |
| 9 | 0 |
| 10 | 18.3 |
| 11 | 17.2 |
| 12 | 9.4 |

## Transistors

| Ref. | b | c | e |
|---|---|---|---|
| Q002 | 5.9 | 11.7 | 5.3 |
| Q003 | .7 | 0 | 0 |
| Q004 | 4.9 | 5.7 | 5.8 |
| Q007 | 0.6 | 0 | 0 |
| Q008 | 1.6 | 5.2 | 1.6 |
| Q015 | 5.2 | 0 | 5.0 |
| Q101 | 0 | 2.8 | 0 |
| Q103 | 2.8 | 8.1 | 2.2 |
| Q305 | 1.3 | 0 | 2.0 |
| Q306 | 4.6 | 8.2 | 4.0 |
| Q307 | 3.9 | 8.2 | 3.3 |
| Q451 | 0 | 2.4 | 0 |
| Q452 | 0.2 | 0.1 | 0 |
| Q501 | 0.3 | 99.6 | 0 |
| Q531 | 10.6 | 16.4 | 10.2 |
| Q541 | 0 | 3.8 | 0 |
| Q551 | 0.1 | 137.4 | 0 |
| Q753 | 0.5 | 9.4 | 0 |
| Q2301 | 0 | 18.1 | 0 |
| Q2302 | 18.1 | 0 | 18.1 |

## Tuner Voltage Chart

Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.

**NOTE:** Voltage at the 30V test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

**Voltage Reading Are Nominal And May Vary ± 15%**

| – VHF – | |
|---|---|
| Ch. 02 | 4.0V |
| Ch. 06 | 8.2V |
| Ch. 07 | 7.0V |
| Ch. 13 | 9.3V |

| – UHF – | |
|---|---|
| Ch. 14 | 7.7V |
| Ch. 69 | 24V |

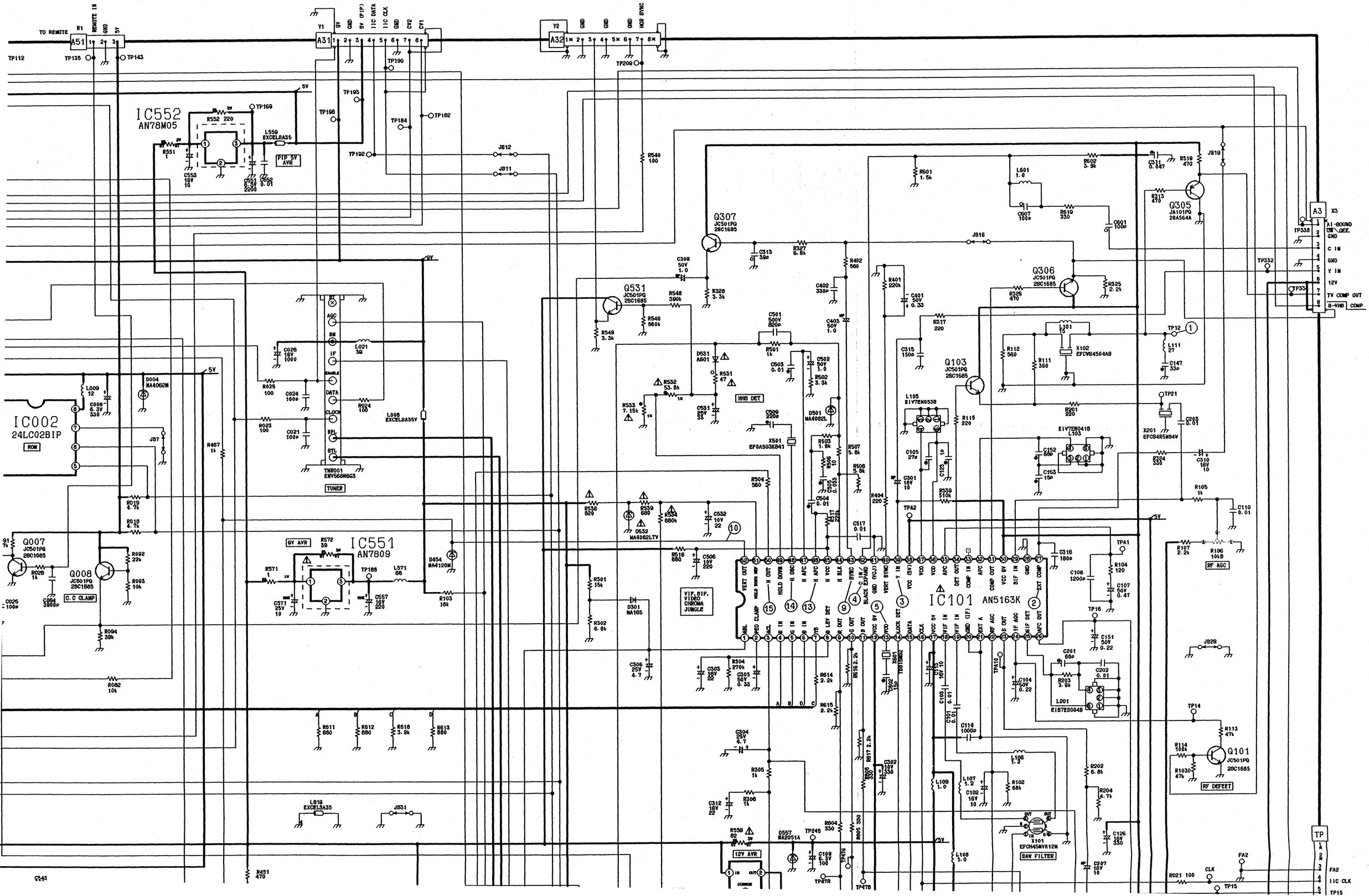
| – CABLE – | | | | | |
|---|---|---|---|---|---|
| 1st Band | | 2nd Band | | 3rd Band | |
| Ch. 1 | 6.7V | Ch. 16 | 4.5V | Ch. 47 | 3.7V |
| Ch. 15 | 24.7V | Ch. 46 | 2.70V | Ch. 94 | 14.9V |
| Ch. 95 | 9.8V | | | Ch. 100 | 15.1V |
| Ch. 99 | 17.5V | | | Ch. 125 | 24.0V |

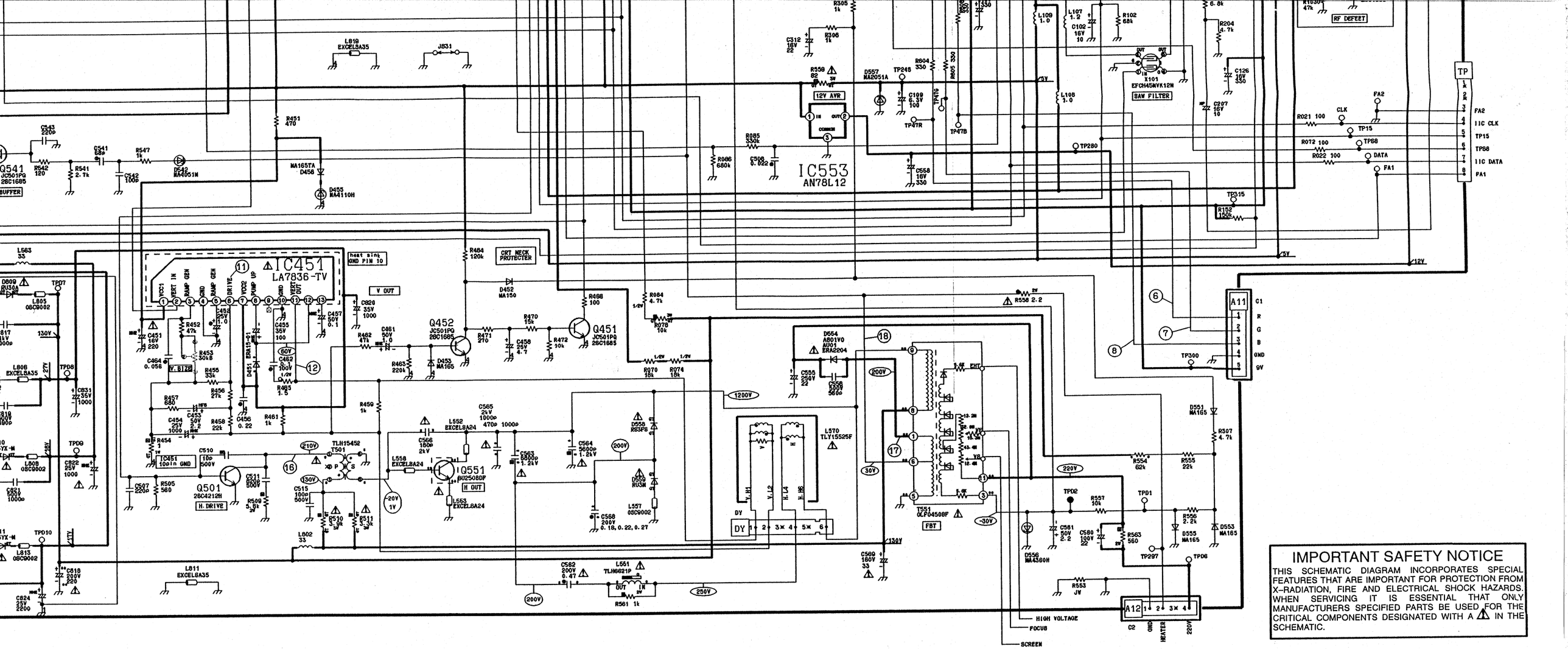
MICROPI

| | |
|---|---|
| VHF | |
| UHF | |
| CAB | |

NOTE: C
E
–(

# Board Schematic (27” Models)






## IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X–RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

# Tuner Voltage Chart

DC readings. They are digital signals from the MPU.
n varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE)

**Voltage Reading Are Nominal And May Vary ± 15%**

| – UHF – | |
|---|---|
| Ch. 14 | 7.7V |
| Ch. 69 | 24V |

| – CABLE – | | | | | |
|---|---|---|---|---|---|
| 1st Band | | 2nd Band | | 3rd Band | |
| Ch. 1 | 6.7V | Ch. 16 | 4.5V | Ch. 47 | 3.7V |
| Ch. 15 | 24.7V | Ch. 46 | 2.70V | Ch. 94 | 14.9V |
| Ch. 95 | 9.8V | | | Ch. 100 | 15.1V |
| Ch. 99 | 17.5V | | | Ch. 125 | 24.0V |

## MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

54MHz ◄► 130MHz ◄► 360MHz ◄► 806MHz

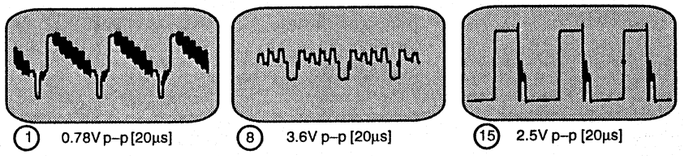
| | FIRST TUNING BAND | SECOND TUNING BAND | THIRD TUNING BAND |
|---|---|---|---|
| VHF | 02~06 | 07~13 | |
| UHF | | | 14~69 |
| CABLE | 01~06,14,15,95~99 | 07~13,16~46 | 47~94,100~125 |

**NOTE:** CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

# Circuit Board Function Index

| CIRCUIT BOARDS | FUNCTION |
|---|---|
| A–BOARD | Main |
| C–BOARD | CRT |
| E–BOARD | Stereo/SAP Decoder |
| R ASSEMBLY | Remote Receiver |
| S–BOARD | 2nd Tuner (PIP) |
| X–BOARD | A/V Input Jacks, V1–V2 Input Switch,TV–Video Switch,AI Sound, Surround Sound, Audio Control & Variable Audio Output |
| Y–BOARD | PIP Processing Assembly |
| Z–BOARD | Pincushion Correction **(31" Models Only)** |

# Waveforms – A–Schematic (31" Models)



① 0.78V p–p [20µs]
⑧ 3.6V p–p [20µs]
⑮ 2.5V p–p [20µs]
② 0.73V p–p [20µs]
⑨ 1.2V p–p [20µs]
⑯ 200V p–p [20µs]
③ 0.45V p–p [20µs]
⑩ 4.6V p–p [5ms]
⑰ 254V p–p [20µs]
④ 0.2V p–p [20µs]
⑪ 3V p–p [5ms]
⑱ 29.2V p–p [20µs]
⑤ 0.4V p–p [1µs]
⑫ 56V p–p [5ms]
⑲ 14V p–p [5µs]
⑥ 4.0V p–p [20µs]
⑬ 1.6V p–p [20µs]
⑳ 292V p–p [5µs]
⑦ 3.4V p–p [20µs]
⑭ 0.8V p–p [5µs]

## Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.

   **CAUTION:** Incorrect ground connection of test equipment will result in erroneous readings.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1~3

EIA colors, 100 IRE white and 7.5 IRE black)

3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken with a wideband scope and a probe with low capacity (10 to 1). Shape and peak amplitudes may vary depending on type of Oscilloscope used and calibration.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1~3
COLOR – Waveforms 4~8
VERTICAL – Waveforms 9~12
HORIZONTAL – Waveforms 13~16
CRT DRIVE – Waveforms 17 & 18
POWER SUPPLY – Waveform 19 ~ 21

# Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in μH.
4. Test point indicated by ●, Test point but no pin ⚲.
5. Components indicated with ⚠ symbol are critical parts and replacement should be made with manufacture specified replacement parts only.
6. **— (BOLD LINES)** Indicates the route of B+ supply.
7. This schematic diagram is the latest at the time of printing and subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION** and ⏦ indicates COLD GROUND CONNECTION.

**NOTE:** All other component symbols are used for design engineering purposes.

# Voltage Measurements

1. Voltage measurement:
   - AC input to Receiver is 120V. NTSC generator connected to antenna of Receiver. (color bar pattern of 100IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments set for Normalize.

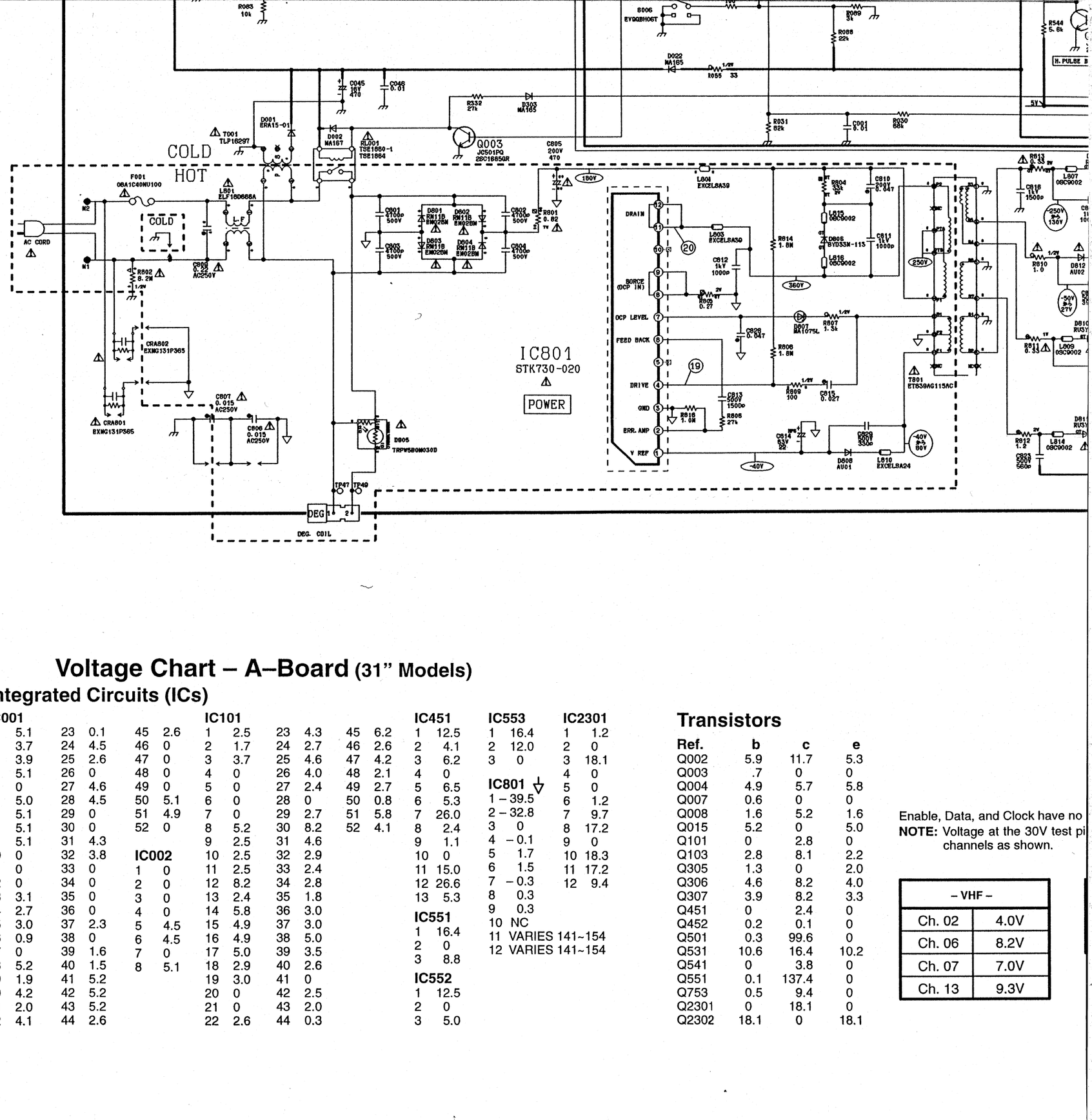
     TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode

     Volume – Min

     TV/Video SW – TV position

     Audio Mode – Stereo
   - Voltage readings are nominal and may vary ±10% on active devices.

     Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**




**Note:** Stereo Models

The Functions listed below are activated by a DC voltage change to DAC Inputs ( Pin 18 and 19 ) of MPU IC001. Press and hold a function button on Receiver to take voltage readings.

| FUNCTION | PIN 18 | PIN 19 |
|---|---|---|
| POWER | 0V~0.6V | 0V(Set "OFF") |
| | | 0.7V~3.0V (Set "ON") |
| VOL ◀ | 0.7V~1.2V | 0.7V~3.0V |
| VOL ▶ | 1.3V~1.8V | 0.7V~3.0V |
| CH ▼ | 1.9V~2.4V | 0.7V~3.0V |
| CH ▲ | 2.6V~3.0V | 0.7V~3.0V |
| TV/VIDEO | 3.2V~3.7V | 0.7V~3.0V |
| ACTION | 4.6V~5.0V | 0V~0.6V |

The AUDIO MODES being broadcast are displayed on screen in red by the voltage change to DAC input (Pin 20) of MPU IC001.

| AUDIO MODE BROADCAST | PIN 20 |
|---|---|
| MONO | 4.0V~5.0V |
| SAP | 2.3V~4.0V |
| STEREO | 1.0V~2.0V |
| STEREO & SAP | 0V~0.9V |

# Voltage Chart – A–Board (31" Models)

## Integrated Circuits (ICs)

**IC001**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 5.1 | 23 | 0.1 | 45 | 2.6 |
| 2 | 3.7 | 24 | 4.5 | 46 | 0 |
| 3 | 3.9 | 25 | 2.6 | 47 | 0 |
| 4 | 5.1 | 26 | 0 | 48 | 0 |
| 5 | 0 | 27 | 4.6 | 49 | 0 |
| 6 | 5.0 | 28 | 4.5 | 50 | 5.1 |
| 7 | 5.1 | 29 | 0 | 51 | 4.9 |
| 8 | 5.1 | 30 | 0 | 52 | 0 |
| 9 | 5.1 | 31 | 4.3 | | |
| 10 | 0 | 32 | 3.8 | | |
| 11 | 0 | 33 | 0 | | |
| 12 | 0 | 34 | 0 | | |
| 13 | 3.1 | 35 | 0 | | |
| 14 | 2.7 | 36 | 0 | | |
| 15 | 3.0 | 37 | 2.3 | | |
| 16 | 0.9 | 38 | 0 | | |
| 17 | 0 | 39 | 1.6 | | |
| 18 | 5.2 | 40 | 1.5 | | |
| 19 | 1.9 | 41 | 5.2 | | |
| 20 | 4.2 | 42 | 5.2 | | |
| 21 | 2.0 | 43 | 5.2 | | |
| 22 | 4.1 | 44 | 2.6 | | |

**IC002**

| | |
|---|---|
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 4.5 |
| 6 | 4.5 |
| 7 | 0 |
| 8 | 5.1 |

**IC101**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2.5 | 23 | 4.3 | 45 | 6.2 |
| 2 | 1.7 | 24 | 2.7 | 46 | 2.6 |
| 3 | 3.7 | 25 | 4.6 | 47 | 4.2 |
| 4 | 0 | 26 | 4.0 | 48 | 2.1 |
| 5 | 0 | 27 | 2.4 | 49 | 2.7 |
| 6 | 0 | 28 | 0 | 50 | 0.8 |
| 7 | 0 | 29 | 2.7 | 51 | 5.8 |
| 8 | 5.2 | 30 | 8.2 | 52 | 4.1 |
| 9 | 2.5 | 31 | 4.6 | | |
| 10 | 2.5 | 32 | 2.9 | | |
| 11 | 2.5 | 33 | 2.4 | | |
| 12 | 8.2 | 34 | 2.8 | | |
| 13 | 2.4 | 35 | 1.8 | | |
| 14 | 5.8 | 36 | 3.0 | | |
| 15 | 4.9 | 37 | 3.0 | | |
| 16 | 4.9 | 38 | 5.0 | | |
| 17 | 5.0 | 39 | 3.5 | | |
| 18 | 2.9 | 40 | 2.6 | | |
| 19 | 3.0 | 41 | 0 | | |
| 20 | 0 | 42 | 2.5 | | |
| 21 | 0 | 43 | 2.0 | | |
| 22 | 2.6 | 44 | 0.3 | | |

**IC451**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 4.1 |
| 3 | 6.2 |
| 4 | 0 |
| 5 | 6.5 |
| 6 | 5.3 |
| 7 | 26.0 |
| 8 | 2.4 |
| 9 | 1.1 |
| 10 | 0 |
| 11 | 15.0 |
| 12 | 26.6 |
| 13 | 5.3 |

**IC551**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 0 |
| 3 | 8.8 |

**IC552**

| | |
|---|---|
| 1 | 12.5 |
| 2 | 0 |
| 3 | 5.0 |

**IC553**

| | |
|---|---|
| 1 | 16.4 |
| 2 | 12.0 |
| 3 | 0 |

**IC801** ⏚

| | |
|---|---|
| 1 | 39.5 |
| 2 | 32.8 |
| 3 | 0 |
| 4 | –0.1 |
| 5 | 1.7 |
| 6 | 1.5 |
| 7 | –0.3 |
| 8 | 0.3 |
| 9 | 0.3 |
| 10 | NC |
| 11 | VARIES 141~154 |
| 12 | VARIES 141~154 |

**IC2301**

| | |
|---|---|
| 1 | 1.2 |
| 2 | 0 |
| 3 | 18.1 |
| 4 | 0 |
| 5 | 0 |
| 6 | 1.2 |
| 7 | 9.7 |
| 8 | 17.2 |
| 9 | 0 |
| 10 | 18.3 |
| 11 | 17.2 |
| 12 | 9.4 |

## Transistors

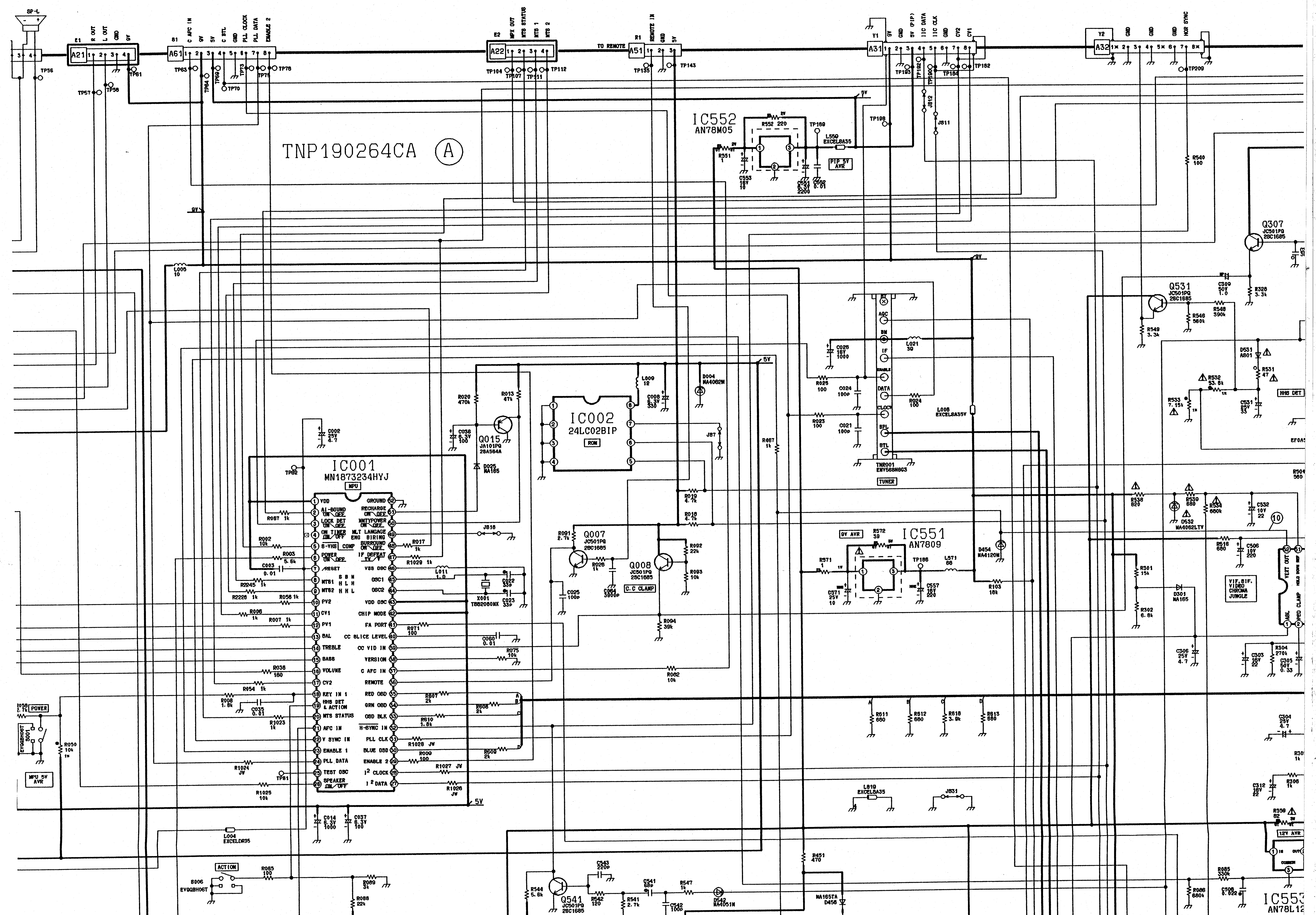
| Ref. | b | c | e |
|---|---|---|---|
| Q002 | 5.9 | 11.7 | 5.3 |
| Q003 | .7 | 0 | 0 |
| Q004 | 4.9 | 5.7 | 5.8 |
| Q007 | 0.6 | 0 | 0 |
| Q008 | 1.6 | 5.2 | 1.6 |
| Q015 | 5.2 | 0 | 5.0 |
| Q101 | 0 | 2.8 | 0 |
| Q103 | 2.8 | 8.1 | 2.2 |
| Q305 | 1.3 | 0 | 2.0 |
| Q306 | 4.6 | 8.2 | 4.0 |
| Q307 | 3.9 | 8.2 | 3.3 |
| Q451 | 0 | 2.4 | 0 |
| Q452 | 0.2 | 0.1 | 0 |
| Q501 | 0.3 | 99.6 | 0 |
| Q531 | 10.6 | 16.4 | 10.2 |
| Q541 | 0 | 3.8 | 0 |
| Q551 | 0.1 | 137.4 | 0 |
| Q753 | 0.5 | 9.4 | 0 |
| Q2301 | 0 | 18.1 | 0 |
| Q2302 | 18.1 | 0 | 18.1 |

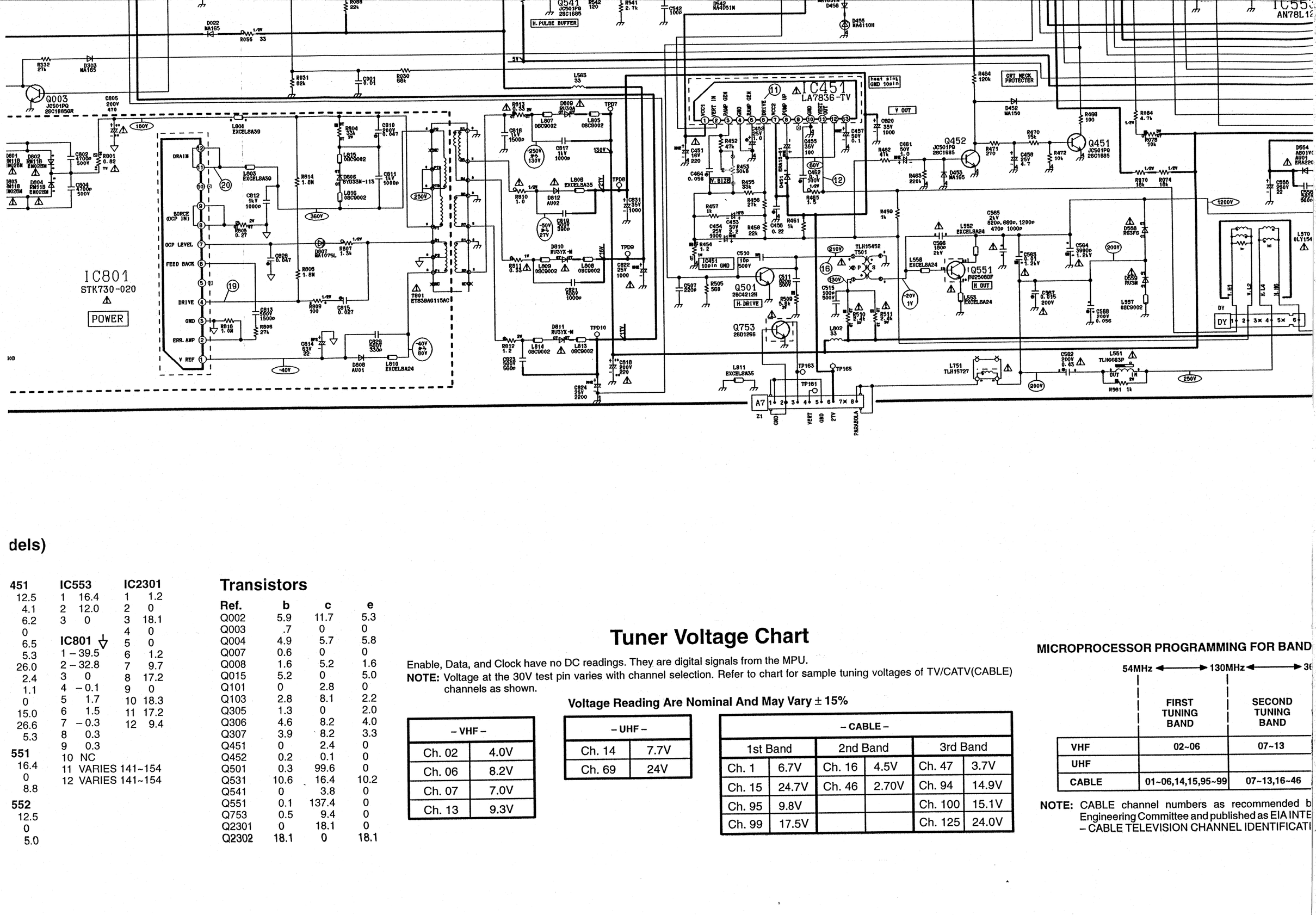
Enable, Data, and Clock have no

**NOTE:** Voltage at the 30V test pi channels as shown.

| – VHF – | |
|---|---|
| Ch. 02 | 4.0V |
| Ch. 06 | 8.2V |
| Ch. 07 | 7.0V |
| Ch. 13 | 9.3V |

# A–Board Schematic (31" Models)






dels)

| 451 | IC553 | IC2301 |
|---|---|---|
| 12.5 | 1 16.4 | 1 1.2 |
| 4.1 | 2 12.0 | 2 0 |
| 6.2 | 3 0 | 3 18.1 |
| 0 | | 4 0 |
| 6.5 | IC801 | 5 0 |
| 5.3 | 1 – 39.5 | 6 1.2 |
| 26.0 | 2 – 32.8 | 7 9.7 |
| 2.4 | 3 0 | 8 17.2 |
| 1.1 | 4 – 0.1 | 9 0 |
| 0 | 5 1.7 | 10 18.3 |
| 15.0 | 6 1.5 | 11 17.2 |
| 26.6 | 7 – 0.3 | 12 9.4 |
| 5.3 | 8 0.3 | |
| **551** | 9 0.3 | |
| 16.4 | 10 NC | |
| 0 | 11 VARIES 141~154 | |
| 8.8 | 12 VARIES 141~154 | |
| **552** | | |
| 12.5 | | |
| 0 | | |
| 5.0 | | |

## Transistors

| Ref. | b | c | e |
|---|---|---|---|
| Q002 | 5.9 | 11.7 | 5.3 |
| Q003 | .7 | 0 | 0 |
| Q004 | 4.9 | 5.7 | 5.8 |
| Q007 | 0.6 | 0 | 0 |
| Q008 | 1.6 | 5.2 | 1.6 |
| Q015 | 5.2 | 0 | 5.0 |
| Q101 | 0 | 2.8 | 0 |
| Q103 | 2.8 | 8.1 | 2.2 |
| Q305 | 1.3 | 0 | 2.0 |
| Q306 | 4.6 | 8.2 | 4.0 |
| Q307 | 3.9 | 8.2 | 3.3 |
| Q451 | 0 | 2.4 | 0 |
| Q452 | 0.2 | 0.1 | 0 |
| Q501 | 0.3 | 99.6 | 0 |
| Q531 | 10.6 | 16.4 | 10.2 |
| Q541 | 0 | 3.8 | 0 |
| Q551 | 0.1 | 137.4 | 0 |
| Q753 | 0.5 | 9.4 | 0 |
| Q2301 | 0 | 18.1 | 0 |
| Q2302 | 18.1 | 0 | 18.1 |

# Tuner Voltage Chart

Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.

**NOTE:** Voltage at the 30V test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

**Voltage Reading Are Nominal And May Vary ± 15%**

| – VHF – | |
|---|---|
| Ch. 02 | 4.0V |
| Ch. 06 | 8.2V |
| Ch. 07 | 7.0V |
| Ch. 13 | 9.3V |

| – UHF – | |
|---|---|
| Ch. 14 | 7.7V |
| Ch. 69 | 24V |

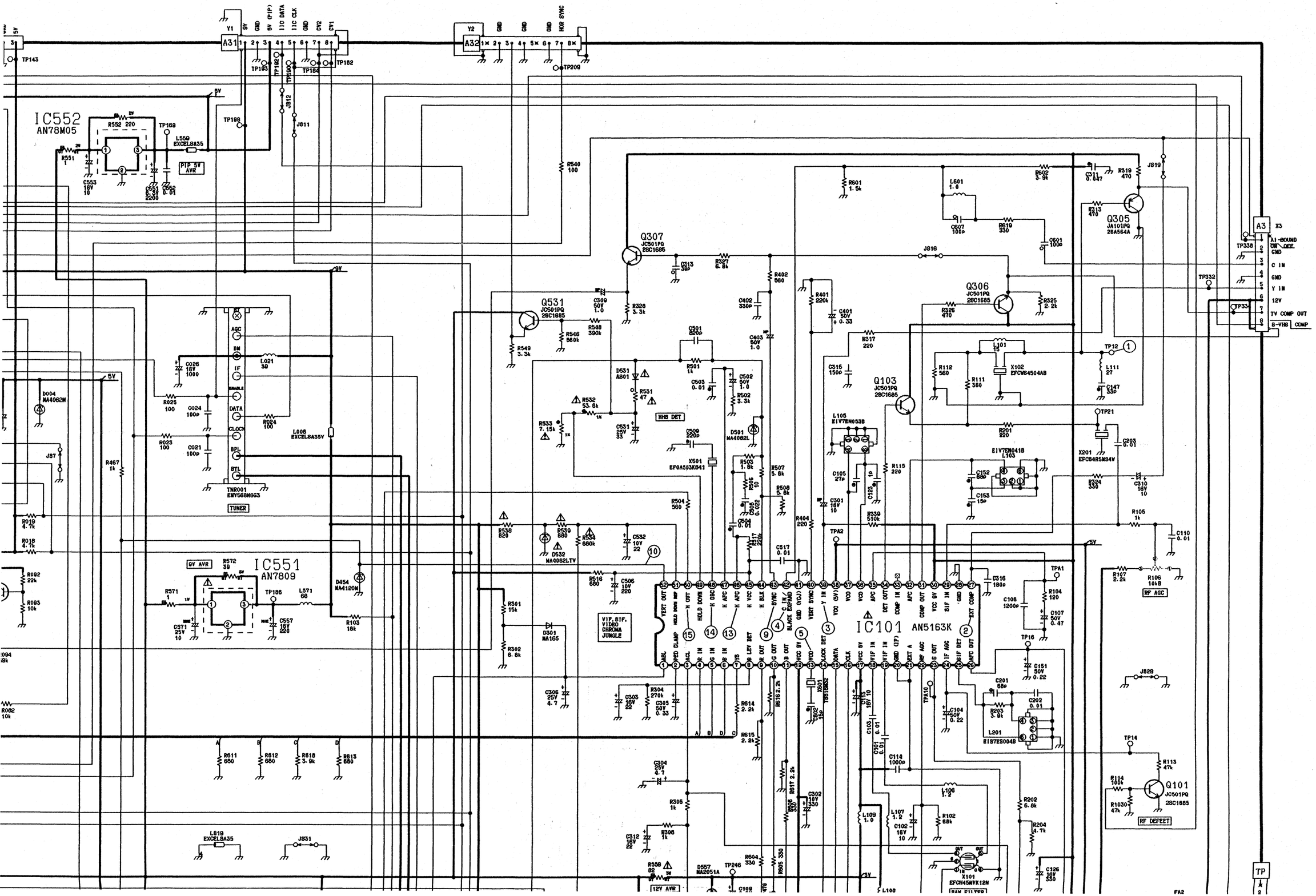
| – CABLE – | | | | | |
|---|---|---|---|---|---|
| 1st Band | | 2nd Band | | 3rd Band | |
| Ch. 1 | 6.7V | Ch. 16 | 4.5V | Ch. 47 | 3.7V |
| Ch. 15 | 24.7V | Ch. 46 | 2.70V | Ch. 94 | 14.9V |
| Ch. 95 | 9.8V | | | Ch. 100 | 15.1V |
| Ch. 99 | 17.5V | | | Ch. 125 | 24.0V |

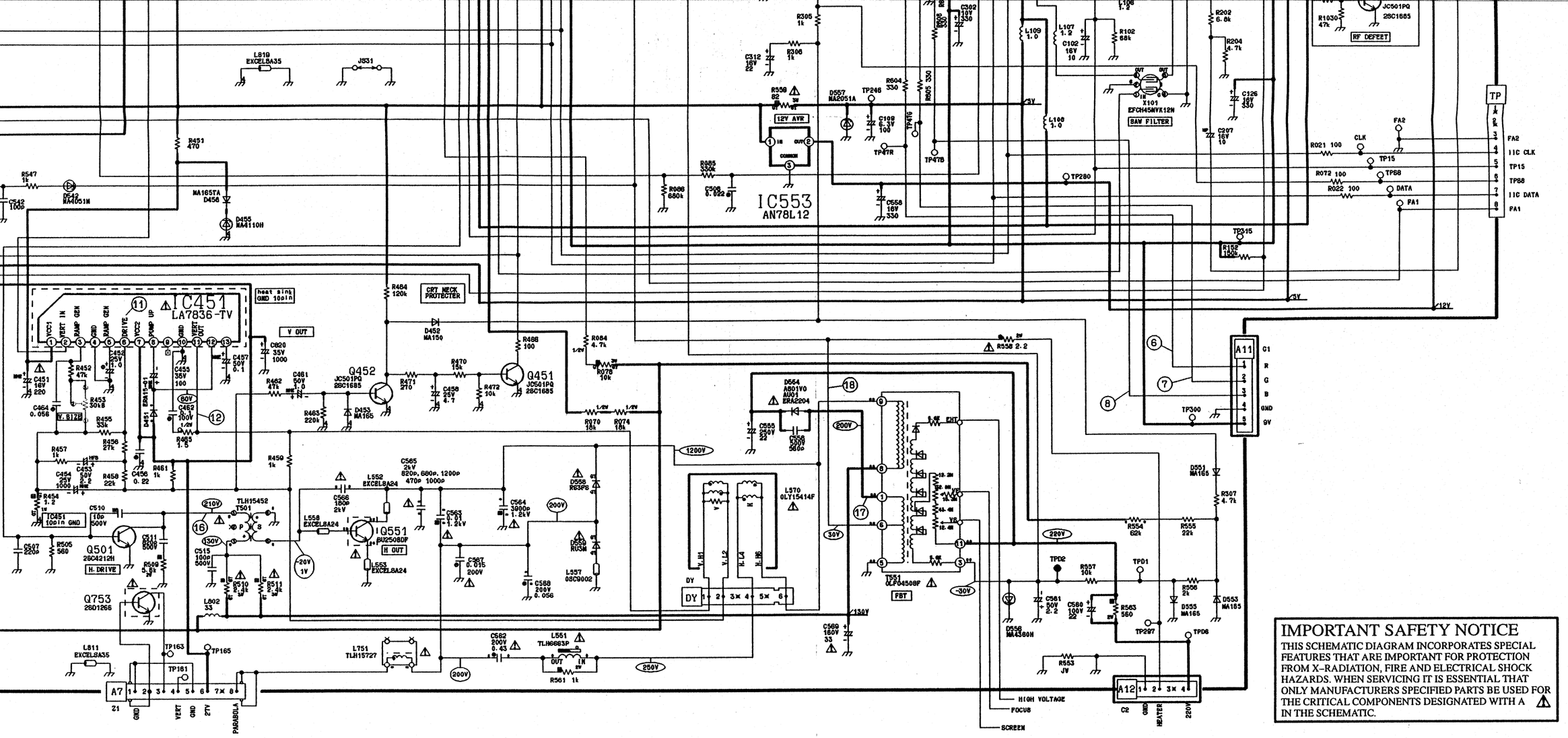
**MICROPROCESSOR PROGRAMMING FOR BAND**

| | 54MHz ◄ FIRST TUNING BAND | 130MHz ► SECOND TUNING BAND |
|---|---|---|
| VHF | 02~06 | 07~13 |
| UHF | | |
| CABLE | 01~06,14,15,95~99 | 07~13,16~46 |

**NOTE:** CABLE channel numbers as recommended b
Engineering Committee and published as EIA INTE
– CABLE TELEVISION CHANNEL IDENTIFICATI

# chematic (31” Models)






## Voltage Chart

e digital signals from the MPU.
selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE)

**Are Nominal And May Vary ± 15%**

| – CABLE – | | | | | |
|---|---|---|---|---|---|
| 1st Band | | 2nd Band | | 3rd Band | |
| Ch. 1 | 6.7V | Ch. 16 | 4.5V | Ch. 47 | 3.7V |
| Ch. 15 | 24.7V | Ch. 46 | 2.70V | Ch. 94 | 14.9V |
| Ch. 95 | 9.8V | | | Ch. 100 | 15.1V |
| Ch. 99 | 17.5V | | | Ch. 125 | 24.0V |

**MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING**

54MHz ◄► 130MHz ◄► 360MHz ◄► 806MHz

| | FIRST TUNING BAND | SECOND TUNING BAND | THIRD TUNING BAND |
|---|---|---|---|
| VHF | 02~06 | 07~13 | |
| UHF | | | 14~69 |
| CABLE | 01~06,14,15,95~99 | 07~13,16~46 | 47~94,100~125 |

**NOTE:** CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

## Circuit Board Function Index

| CIRCUIT BOARDS | FUNCTION |
|---|---|
| A–BOARD | Main |
| C–BOARD | CRT |
| E–BOARD | Stereo/SAP Decoder |
| R ASSEMBLY | Remote Receiver |
| S–BOARD | 2nd Tuner (PIP) |
| X–BOARD | A/V Input Jacks, V1–V2 Input Switch,TV–Video Switch,AI Sound, Surround Sound, Audio Control & Variable Audio Output |
| Y–BOARD | PIP Processing Assembly |
| Z–BOARD | Pincushion Correction **(31" Models Only)** |

### IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X–RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

Sheet 3 of 5

X & Y–Board Schematics
(All Models)

## Y–Board Schematics (All Models)

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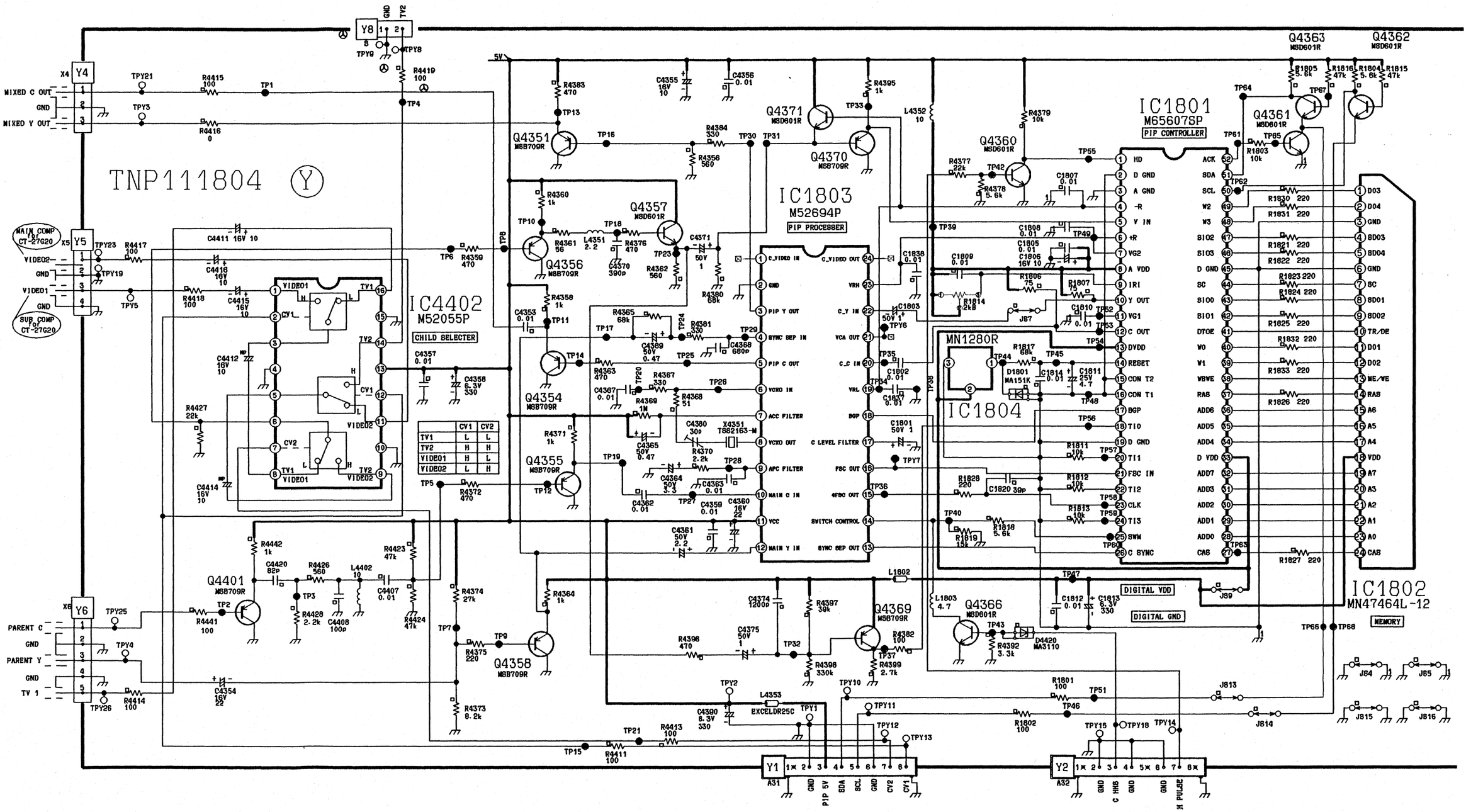


# Voltage Chart – Y–Board (All Models)

## Integrated Circuits (ICs)

**IC1801**

| | | | |
|---|---|---|---|
| 1 | 0.2 | 27 | 4.8 |
| 2 | 0 | 28 | 0 |
| 3 | 0 | 29 | 2.6 |
| 4 | 2.6 | 30 | 2.6 |
| 5 | 3.0 | 31 | 2.6 |
| 6 | 3.7 | 32 | 0 |
| 7 | 3.7 | 33 | 4.8 |
| 8 | 5.0 | 34 | 2.6 |
| 9 | 3.7 | 35 | 2.6 |
| 10 | 4.6 | 36 | 0 |
| 11 | 2.1 | 37 | 4.8 |
| 12 | 4.6 | 38 | 4.8 |
| 13 | 4.8 | 39 | 4.2 |
| 14 | 4.8 | 40 | 0.2 |
| 15 | 0 | 41 | 4.8 |
| 16 | 0 | 42 | 0 |
| 17 | 0.2 | 43 | 0 |
| 18 | 0.4 | 44 | 0 |
| 19 | 0 | 45 | 0 |
| 20 | 4.8 | 46 | 0 |
| 21 | 1.8 | 47 | 0 |
| 22 | 0 | 48 | 1.8 |
| 23 | 1.7 | 49 | 4.8 |
| 24 | 0 | 50 | 4.4 |
| 25 | 0 | 51 | 4.6 |
| 26 | 1.0 | 52 | 0 |

**IC1804**

| | |
|---|---|
| 1 | 4.8 |
| 2 | 4.8 |
| 3 | 0 |

**IC1802**

| | | | |
|---|---|---|---|
| 1 | 4.8 | 13 | 4.8 |
| 2 | 1.8 | 14 | 4.8 |
| 3 | 0 | 15 | 0 |
| 4 | 0 | 16 | 2.6 |
| 5 | 0 | 17 | 2.6 |
| 6 | 0 | 18 | 4.8 |
| 7 | 0 | 19 | 0 |
| 8 | 0 | 20 | 2.6 |
| 9 | 0 | 21 | 2.6 |
| 10 | 4.8 | 22 | 2.6 |
| 11 | 0.2 | 23 | 0 |
| 12 | 4.2 | 24 | 4.8 |

**IC1803**

| | | | |
|---|---|---|---|
| 1 | 2.6 | 13 | 1.0 |
| 2 | 0 | 14 | 0 |
| 3 | 1.7 | 15 | 1.6 |
| 4 | 3.1 | 16 | 1.8 |
| 5 | 1.3 | 17 | 2.2 |
| 6 | 3.4 | 18 | 0.2 |
| 7 | 4.2 | 19 | 2.6 |
| 8 | 2.8 | 20 | 2.6 |
| 9 | 2.4 | 21 | 3.0 |
| 10 | 2.8 | 22 | 3.4 |
| 11 | 5.0 | 23 | 3.7 |
| 12 | 3.3 | 24 | 2.6 |

**IC4402**

| | | | |
|---|---|---|---|
| 1 | 2.8 | 9 | 2.8 |
| 2 | 0 | 10 | 0 |
| 3 | 1.6 | 11 | 2.8 |
| 4 | 0 | 12 | 0 |
| 5 | 1.6 | 13 | 5.0 |
| 6 | 1.6 | 14 | 2.8 |
| 7 | 0 | 15 | 0 |
| 8 | 2.8 | 16 | 2.8 |

## Transistors

| Ref. | b | c | e |
|---|---|---|---|
| Q4351 | 1.2 | 0 | 1.8 |
| Q4354 | 1.3 | 0 | 2.0 |
| Q4355 | 2.6 | 0 | 3.3 |
| Q4356 | 1.6 | 0 | 2.2 |
| Q4357 | 2.2 | 5.0 | 1.6 |
| Q4358 | 1.2 | 0 | 1.8 |
| Q4360 | 0.6 | 0.2 | 0 |
| Q4361 | 0 | 4.6 | 0 |
| Q4362 | 4.4 | 4.4 | 4.6 |
| Q4363 | 4.6 | 4.6 | 4.6 |
| Q4366 | 0 | 0 | 0 |
| Q4369 | 4.6 | 0 | 5.0 |
| Q4370 | 2.3 | 0 | 3.0 |
| Q4371 | 2.6 | 5.0 | 2.3 |
| Q4401 | 2.8 | 0 | 3.6 |

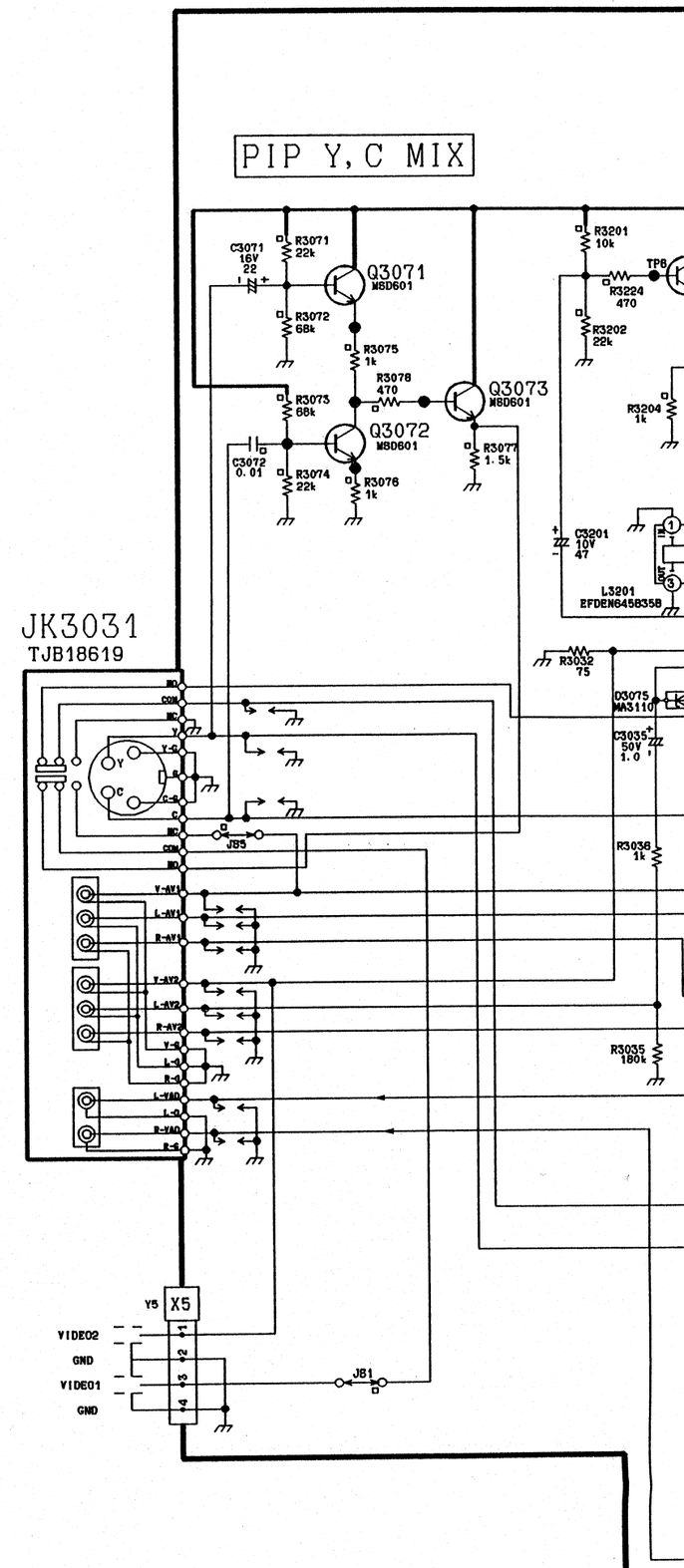
## Connectors

**Y1**

| | |
|---|---|
| 1 | 8.7 |
| 2 | 0 |
| 3 | 4.9 |
| 4 | 4.6 |
| 5 | 4.5 |
| 6 | 0 |
| 7 | 0 |
| 8 | 0 |

**Y2**

| | |
|---|---|
| 1 | 0 |
| 2 | 0 |
| 3 | 9.5 |
| 4 | 0 |
| 5 | 0 |
| 6 | 0 |
| 7 | 3.8 |
| 8 | 0 |

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# X & Y–Board Schematic (All Models)

## X–Board Schematics (All Models)

PIP Y,C MIX

X BOARD TNP111803BZ

JK3031
TJB18619

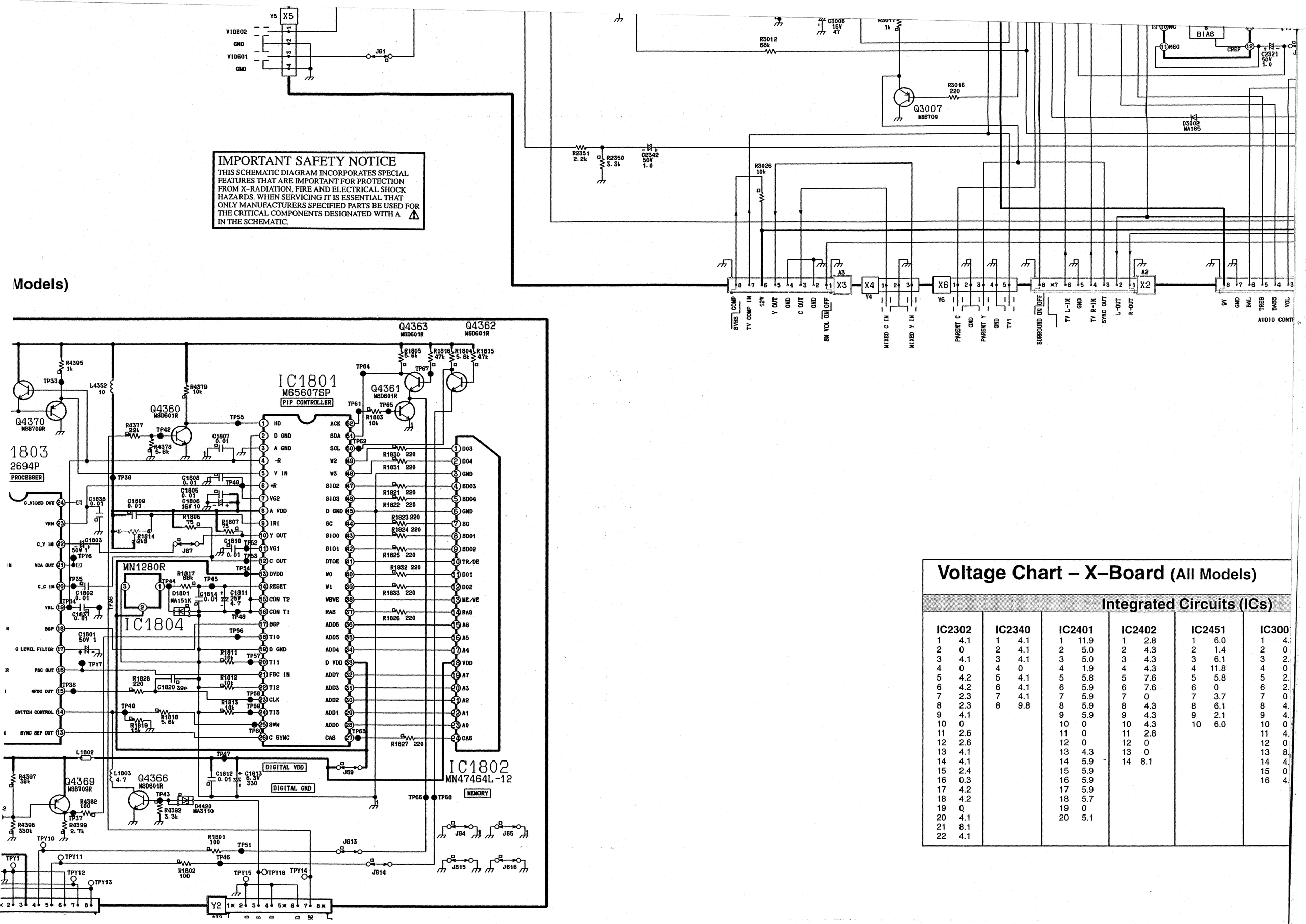
IC3031
M52055P
V1/V2 SW

IC3001
M52055P

TV/VIDEO SWITCH
IC2402
MC14066BCP
MN4066B
M4066BP
UPD4066BC

Q3071 MSD601
Q3072 MSD601
Q3073 MSD601
Q3201 MSD601 COMP-EF
Q3202 MSD601 SUBTRACTER
Q3203 MSD601 ADDER
Q3204 MSD601 C-EF
Q3205 MSD601 Y-EF
Q3206 MSD601 BPF SW
Q3007 MSB709
Q2401 MSD601
Q2402 MSD601

CONTROL & BIAS
TONE
VCA

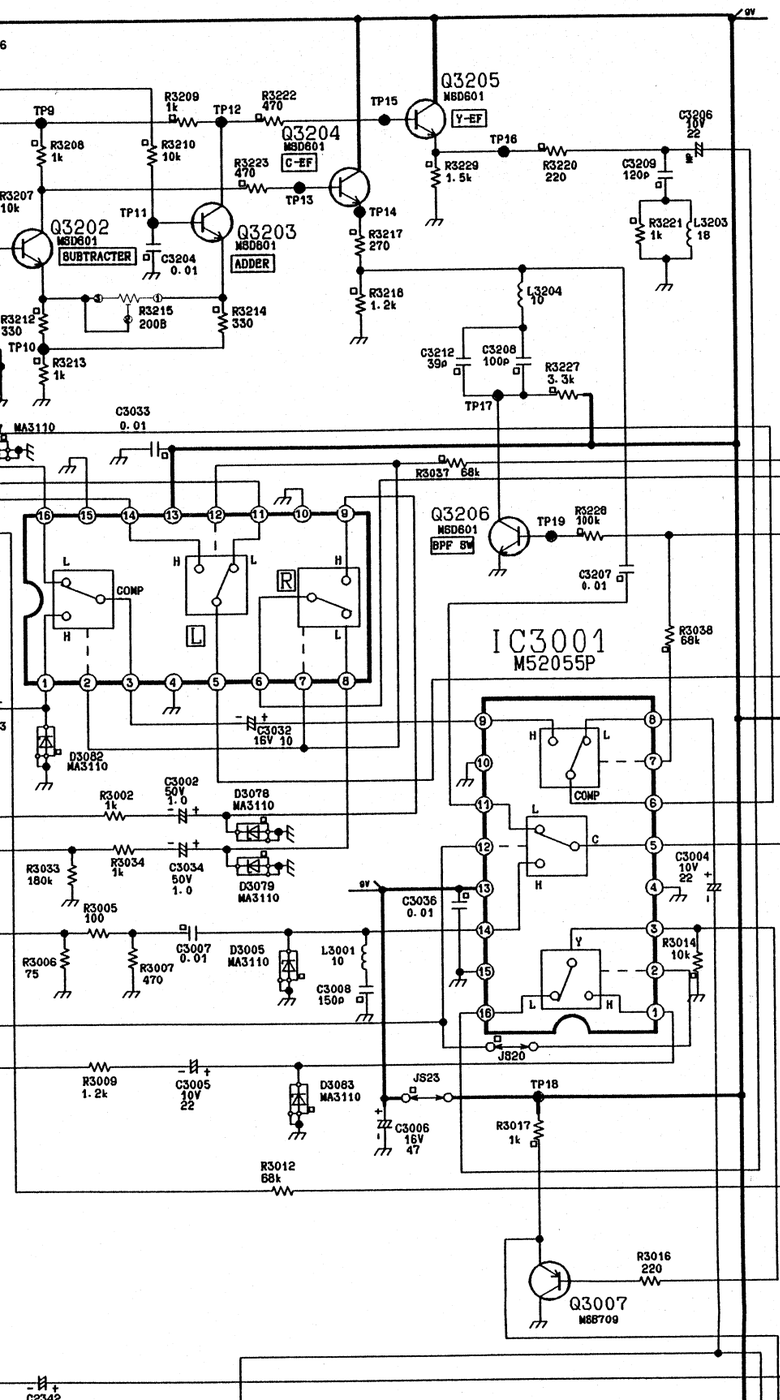


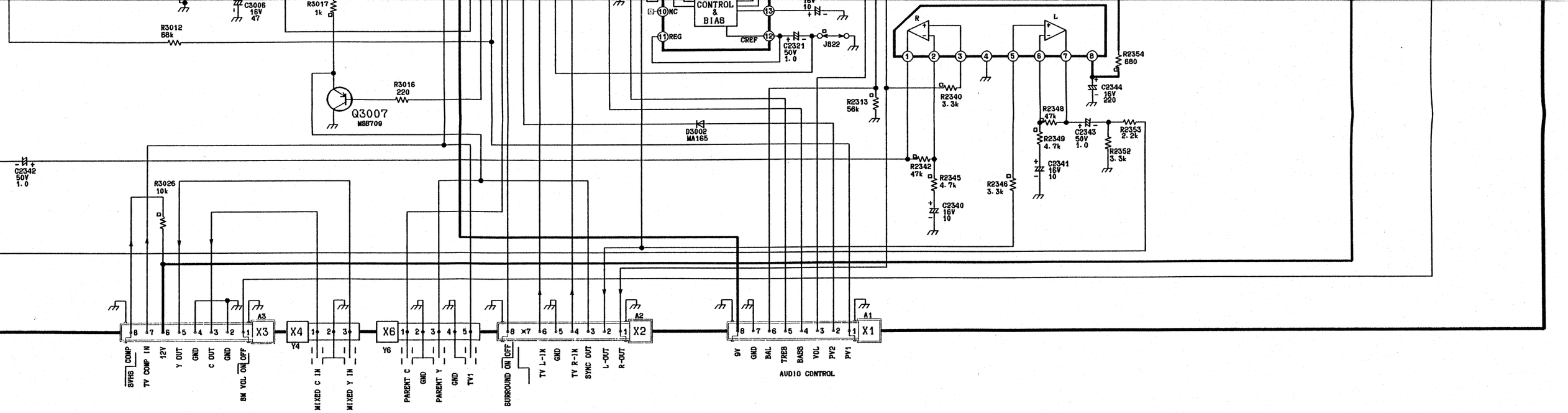

## Voltage Chart – X–Board (All Models)

### Integrated Circuits (ICs)

| IC2302 | | IC2340 | | IC2401 | | IC2402 | | IC2451 | | IC300 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.1 | 1 | 4.1 | 1 | 11.9 | 1 | 2.8 | 1 | 6.0 | 1 | 4. |
| 2 | 0 | 2 | 4.1 | 2 | 5.0 | 2 | 4.3 | 2 | 1.4 | 2 | 0 |
| 3 | 4.1 | 3 | 4.1 | 3 | 5.0 | 3 | 4.3 | 3 | 6.1 | 3 | 2. |
| 4 | 0 | 4 | 0 | 4 | 1.9 | 4 | 4.3 | 4 | 11.8 | 4 | 0 |
| 5 | 4.2 | 5 | 4.1 | 5 | 5.8 | 5 | 7.6 | 5 | 5.8 | 5 | 2. |
| 6 | 4.2 | 6 | 4.1 | 6 | 5.9 | 6 | 7.6 | 6 | 0 | 6 | 2. |
| 7 | 2.3 | 7 | 4.1 | 7 | 5.9 | 7 | 0 | 7 | 3.7 | 7 | 0 |
| 8 | 2.3 | 8 | 9.8 | 8 | 5.9 | 8 | 4.3 | 8 | 6.1 | 8 | 4. |
| 9 | 4.1 | | | 9 | 5.9 | 9 | 4.3 | 9 | 2.1 | 9 | 4. |
| 10 | 0 | | | 10 | 0 | 10 | 4.3 | 10 | 6.0 | 10 | 0 |
| 11 | 2.6 | | | 11 | 0 | 11 | 2.8 | | | 11 | 4. |
| 12 | 2.6 | | | 12 | 0 | 12 | 0 | | | 12 | 0 |
| 13 | 4.1 | | | 13 | 4.3 | 13 | 0 | | | 13 | 8. |
| 14 | 4.1 | | | 14 | 5.9 | 14 | 8.1 | | | 14 | 4. |
| 15 | 2.4 | | | 15 | 5.9 | | | | | 15 | 0 |
| 16 | 0.3 | | | 16 | 5.9 | | | | | 16 | 4. |
| 17 | 4.2 | | | 17 | 5.9 | | | | | | |
| 18 | 4.2 | | | 18 | 5.7 | | | | | | |
| 19 | 0 | | | 19 | 0 | | | | | | |
| 20 | 4.1 | | | 20 | 5.1 | | | | | | |
| 21 | 8.1 | | | | | | | | | | |
| 22 | 4.1 | | | | | | | | | | |

## (X) BOARD TNP111803BZ






# Voltage Chart – X–Board (All Models)

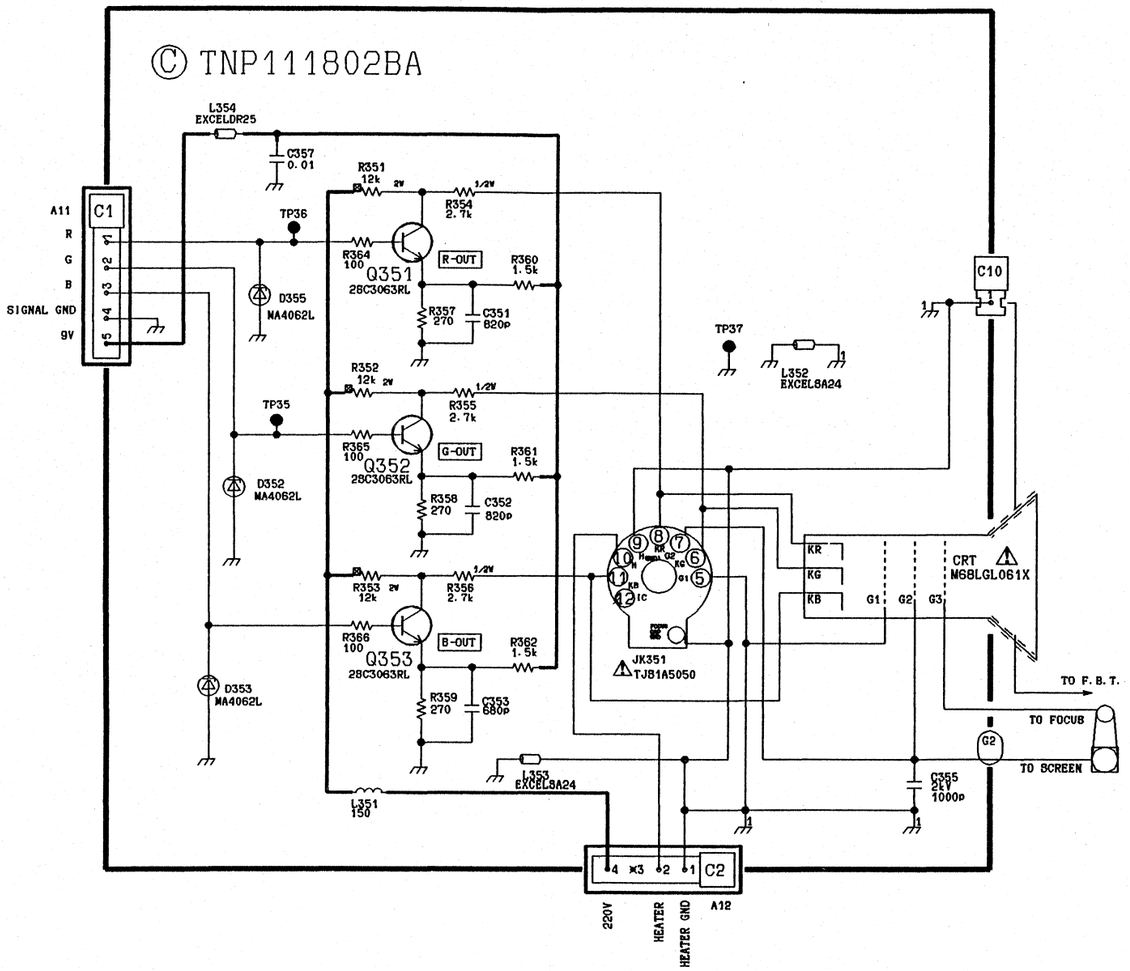
## Integrated Circuits (ICs)

| IC2302 | | IC2340 | | IC2401 | | IC2402 | | IC2451 | | IC3001 | | IC3031 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.1 | 1 | 4.1 | 1 | 11.9 | 1 | 2.8 | 1 | 6.0 | 1 | 4.3 | 1 | 4.3 |
| 2 | 0 | 2 | 4.1 | 2 | 5.0 | 2 | 4.3 | 2 | 1.4 | 2 | 0 | 2 | 0 |
| 3 | 4.1 | 3 | 4.1 | 3 | 5.0 | 3 | 4.3 | 3 | 6.1 | 3 | 2.8 | 3 | 2.9 |
| 4 | 0 | 4 | 0 | 4 | 1.9 | 4 | 4.3 | 4 | 11.8 | 4 | 0 | 4 | 0 |
| 5 | 4.2 | 5 | 4.1 | 5 | 5.8 | 5 | 7.6 | 5 | 5.8 | 5 | 2.8 | 5 | 2.8 |
| 6 | 4.2 | 6 | 4.1 | 6 | 5.9 | 6 | 7.6 | 6 | 0 | 6 | 2.8 | 6 | 2.8 |
| 7 | 2.3 | 7 | 4.1 | 7 | 5.9 | 7 | 0 | 7 | 3.7 | 7 | 0 | 7 | 0 |
| 8 | 2.3 | 8 | 9.8 | 8 | 5.9 | 8 | 4.3 | 8 | 6.1 | 8 | 4.3 | 8 | 4.3 |
| 9 | 4.1 | | | 9 | 5.9 | 9 | 4.3 | 9 | 2.1 | 9 | 4.3 | 9 | 4.3 |
| 10 | 0 | | | 10 | 0 | 10 | 4.3 | 10 | 6.0 | 10 | 0 | 10 | 0 |
| 11 | 2.6 | | | 11 | 0 | 11 | 2.8 | | | 11 | 4.3 | 11 | 4.3 |
| 12 | 2.6 | | | 12 | 0 | 12 | 0 | | | 12 | 0 | 12 | 0 |
| 13 | 4.1 | | | 13 | 4.3 | 13 | 0 | | | 13 | 8.1 | 13 | 8.1 |
| 14 | 4.1 | | | 14 | 5.9 | 14 | 8.1 | | | 14 | 4.3 | 14 | 4.3 |
| 15 | 2.4 | | | 15 | 5.9 | | | | | 15 | 0 | 15 | 0 |
| 16 | 0.3 | | | 16 | 5.9 | | | | | 16 | 4.3 | 16 | 4.3 |
| 17 | 4.2 | | | 17 | 5.9 | | | | | | | | |
| 18 | 4.2 | | | 18 | 5.7 | | | | | | | | |
| 19 | 0 | | | 19 | 0 | | | | | | | | |
| 20 | 4.1 | | | 20 | 5.1 | | | | | | | | |
| 21 | 8.1 | | | | | | | | | | | | |
| 22 | 4.1 | | | | | | | | | | | | |

## Transistors

| Ref. | b | c | e |
|---|---|---|---|
| Q2401 | 0 | 7.6 | 0 |
| Q2402 | 0.8 | 0 | 0 |
| Q3007 | 2.7 | 0 | 3.6 |
| Q3071 | 6.0 | 8.1 | 5.4 |
| Q3072 | 1.8 | 4.1 | 1.3 |
| Q3073 | 4.1 | 8.1 | 3.6 |
| Q3201 | 5.4 | 8.1 | 4.8 |
| Q3202 | 2.3 | 4.0 | 1.6 |
| Q3203 | 2.3 | 4.1 | 1.6 |
| Q3204 | 4.0 | 8.1 | 3.4 |
| Q3205 | 4.1 | 8.1 | 3.4 |
| Q3206 | 0 | 8.1 | 0 |

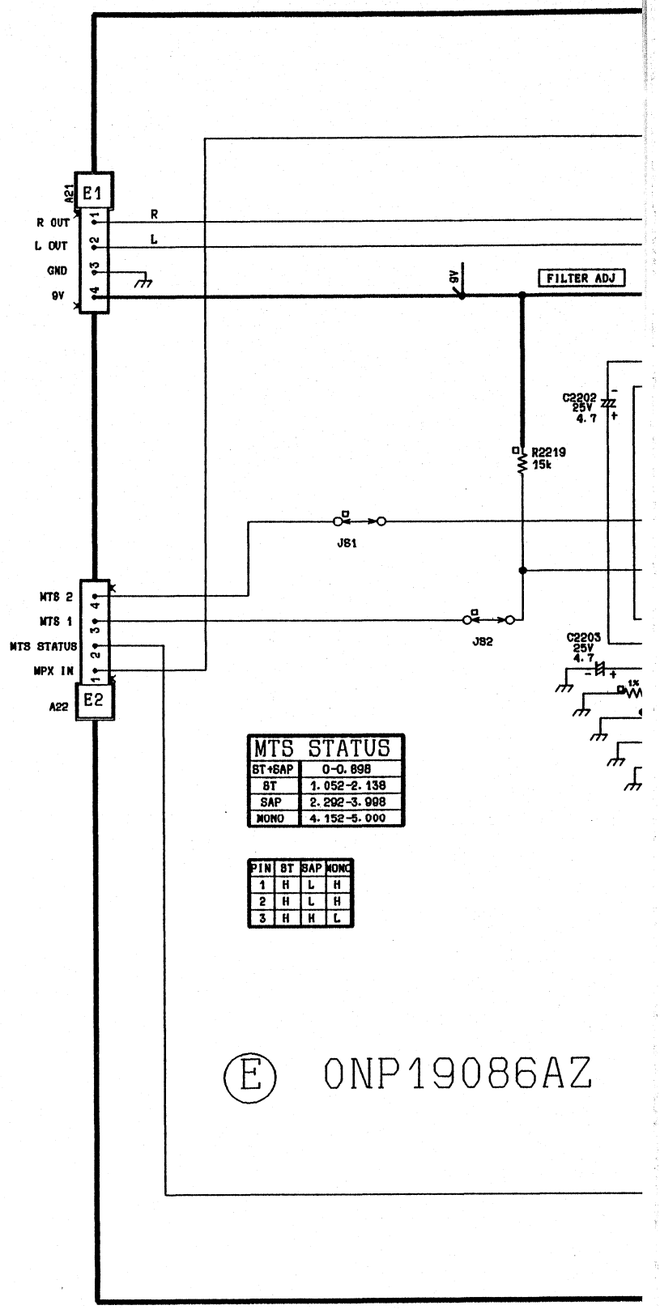
## C–Board Schematics (27” Models)




## Voltage Chart – CRT–Board
### (All Models)

| Transistors | | | |
|---|---|---|---|
| **Ref.** | **b** | **c** | **e** |
| Q351 | 2.8 | 150.8 | 2.3 |
| Q352 | 2.7 | 155.2 | 2.2 |
| Q353 | 2.8 | 153.8 | 2.2 |

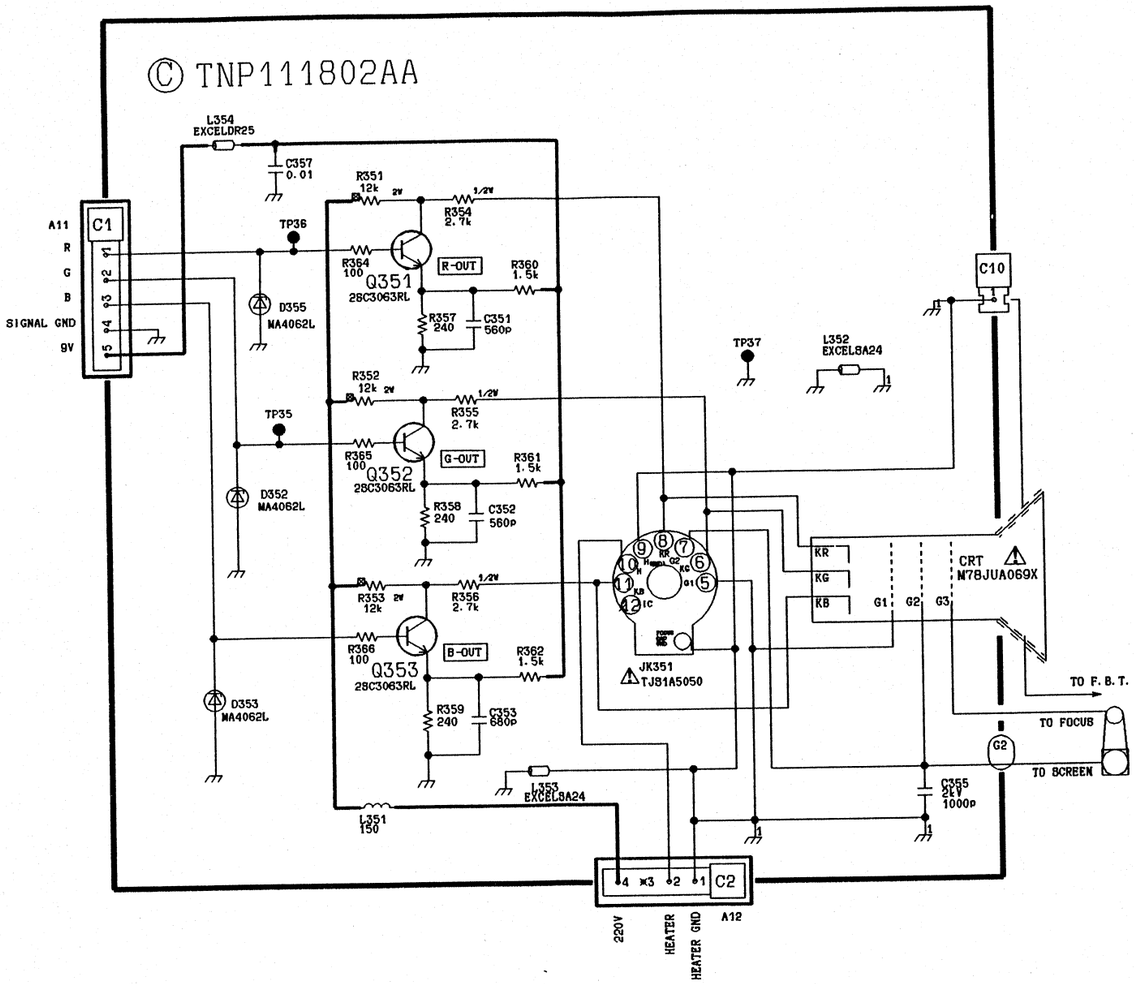
## E–Board Sc



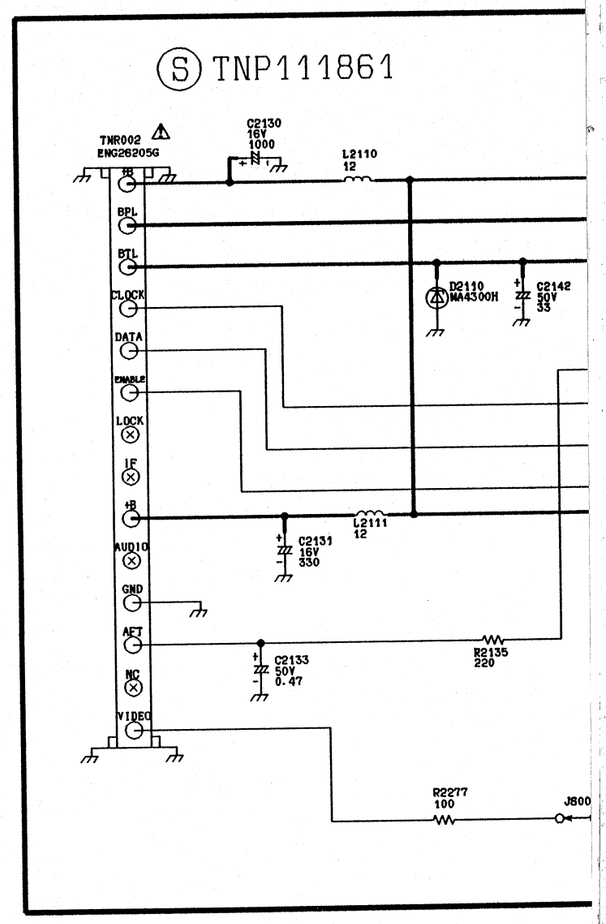
(All Models)

| Transistors | | | |
|---|---|---|---|
| **Ref.** | **b** | **c** | **e** |
| Q351 | 2.8 | 150.8 | 2.3 |
| Q352 | 2.7 | 155.2 | 2.2 |
| Q353 | 2.8 | 153.8 | 2.2 |

## C–Board Schematics (31" Models)

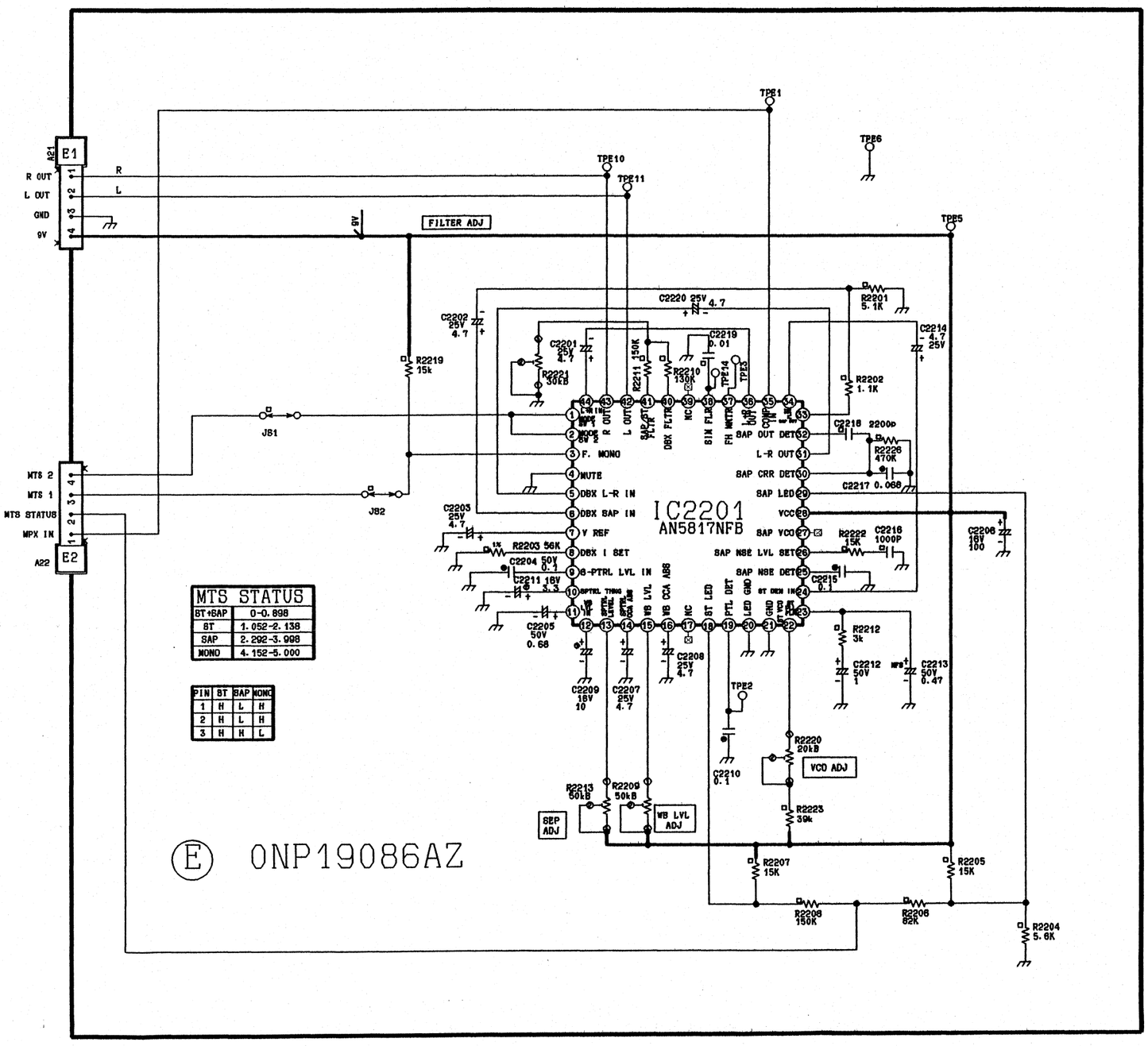



## S–Board Schematics (A



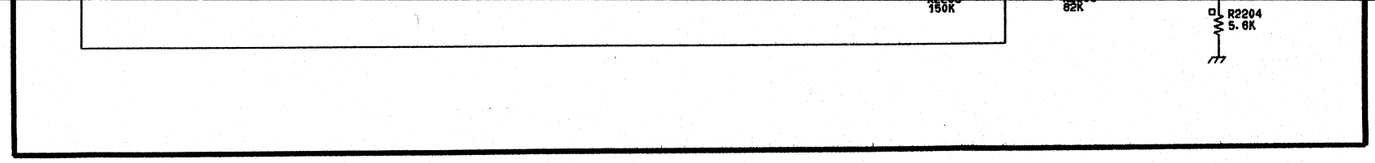
# C, E, R, S, & Z–Board Schematics (All Models)

## E–Board Schematics (All Models)



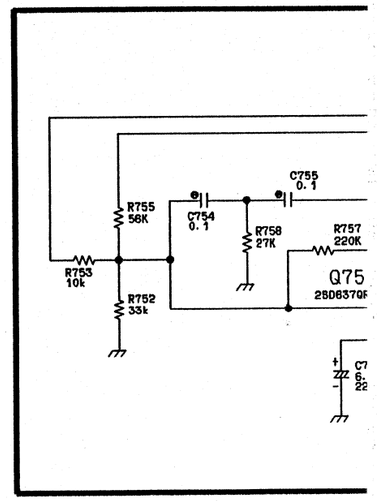

## Voltage Chart – E–Boa
### (All Models)

| Integrated Circuits (ICs) | | | | | |
|---|---|---|---|---|---|
| **IC2201** | | | | | |
| 1 | 2.5 | 12 | 0.4 | 23 | 2.3 |
| 2 | 2.5 | 13 | 2.6 | 24 | 2.2 |
| 3 | 0 | 14 | 1.8 | 25 | 3.1 |
| 4 | 0 | 15 | 1.4 | 26 | 3.2 |
| 5 | 2.1 | 16 | 2.7 | 27 | 0.1 |
| 6 | 2.2 | 17 | 0 | 28 | 4.1 |
| 7 | 2.3 | 18 | 4.2 | 29 | 1.1 |
| 8 | 1.4 | 19 | 2.3 | 30 | 2.3 |
| 9 | 2.2 | 20 | 0 | 31 | 2.0 |
| 10 | 1.1 | 21 | 0 | 32 | 0.3 |
| 11 | 2.5 | 22 | 3.4 | 33 | 2.9 |




| | | | | | |
|---|---|---|---|---|---|
| 4 | 0 | 15 | 1.4 | 26 | 3.2 |
| 5 | 2.1 | 16 | 2.7 | 27 | 0.1 |
| 6 | 2.2 | 17 | 0 | 28 | 4.1 |
| 7 | 2.3 | 18 | 4.2 | 29 | 1.1 |
| 8 | 1.4 | 19 | 2.3 | 30 | 2.3 |
| 9 | 2.2 | 20 | 0 | 31 | 2.0 |
| 10 | 1.1 | 21 | 0 | 32 | 0.3 |
| 11 | 2.5 | 22 | 3.4 | 33 | 2.9 |

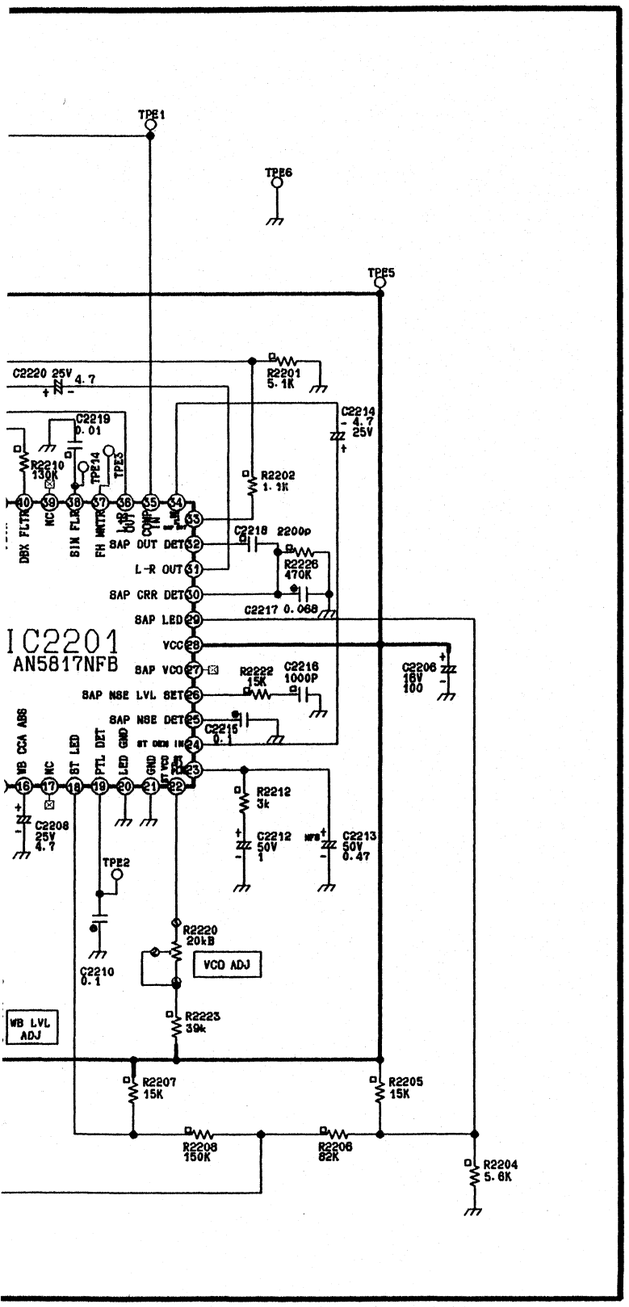
## Z–Board



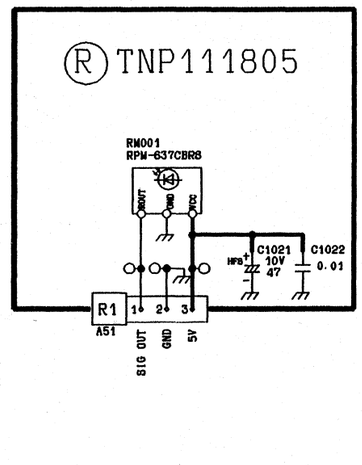

## S–Board Schematics (All Models)

# ıatics (All Models)

## l Models)




## R–Board Schematics (All Models)




## Voltage Chart – E–Board
### (All Models)

**Integrated Circuits (ICs)**

| IC2201 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2.5 | 12 | 0.4 | 23 | 2.3 | 34 | 1.8 |
| 2 | 2.5 | 13 | 2.6 | 24 | 2.2 | 35 | 2.2 |
| 3 | 0 | 14 | 1.8 | 25 | 3.1 | 36 | 1.4 |
| 4 | 0 | 15 | 1.4 | 26 | 3.2 | 37 | 2.2 |
| 5 | 2.1 | 16 | 2.7 | 27 | 0.1 | 38 | 2.2 |
| 6 | 2.2 | 17 | 0 | 28 | 4.1 | 39 | 0 |
| 7 | 2.3 | 18 | 4.2 | 29 | 1.1 | 40 | 1.2 |
| 8 | 1.4 | 19 | 2.3 | 30 | 2.3 | 41 | 0 |
| 9 | 2.2 | 20 | 0 | 31 | 2.0 | 42 | 2.2 |
| 10 | 1.1 | 21 | 0 | 32 | 0.3 | 43 | 2.3 |
| 11 | 2.5 | 22 | 3.4 | 33 | 2.9 | 44 | 2.2 |

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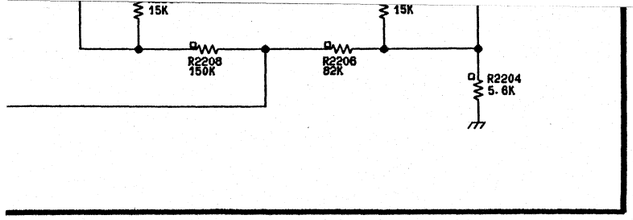


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2.5 | 12 | 0.4 | 23 | 2.3 | 34 | 1.8 |
| 2 | 2.5 | 13 | 2.6 | 24 | 2.2 | 35 | 2.2 |
| 3 | 0 | 14 | 1.8 | 25 | 3.1 | 36 | 1.4 |
| 4 | 0 | 15 | 1.4 | 26 | 3.2 | 37 | 2.2 |
| 5 | 2.1 | 16 | 2.7 | 27 | 0.1 | 38 | 2.2 |
| 6 | 2.2 | 17 | 0 | 28 | 4.1 | 39 | 0 |
| 7 | 2.3 | 18 | 4.2 | 29 | 1.1 | 40 | 1.2 |
| 8 | 1.4 | 19 | 2.3 | 30 | 2.3 | 41 | 0 |
| 9 | 2.2 | 20 | 0 | 31 | 2.0 | 42 | 2.2 |
| 10 | 1.1 | 21 | 0 | 32 | 0.3 | 43 | 2.3 |
| 11 | 2.5 | 22 | 3.4 | 33 | 2.9 | 44 | 2.2 |

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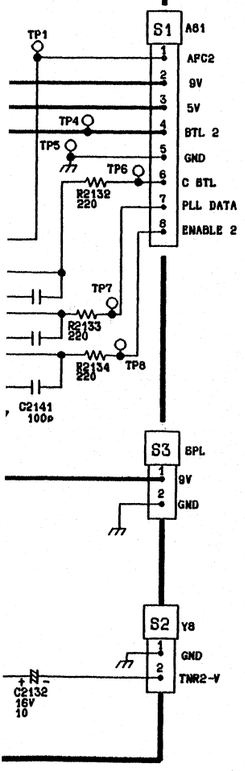
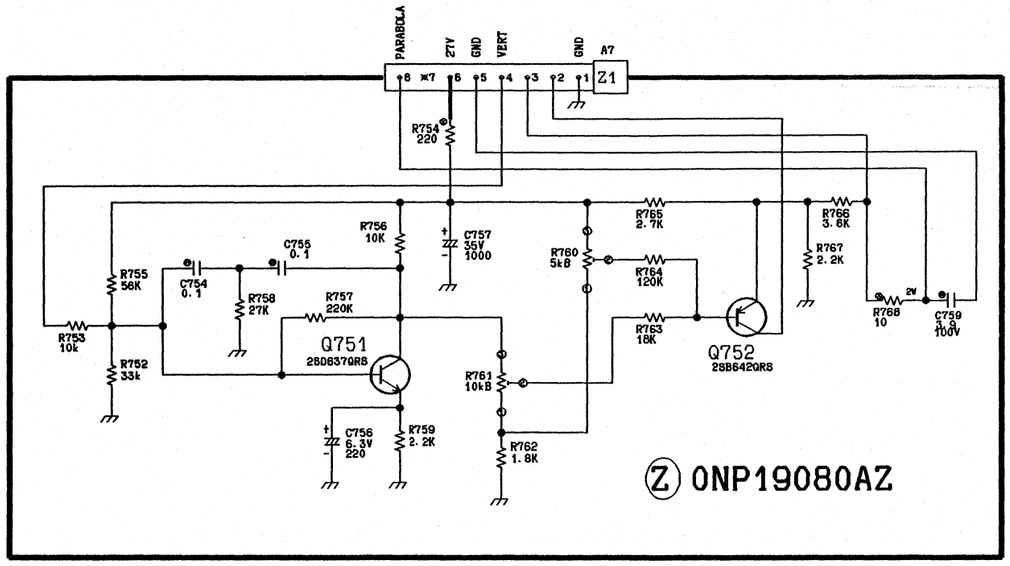


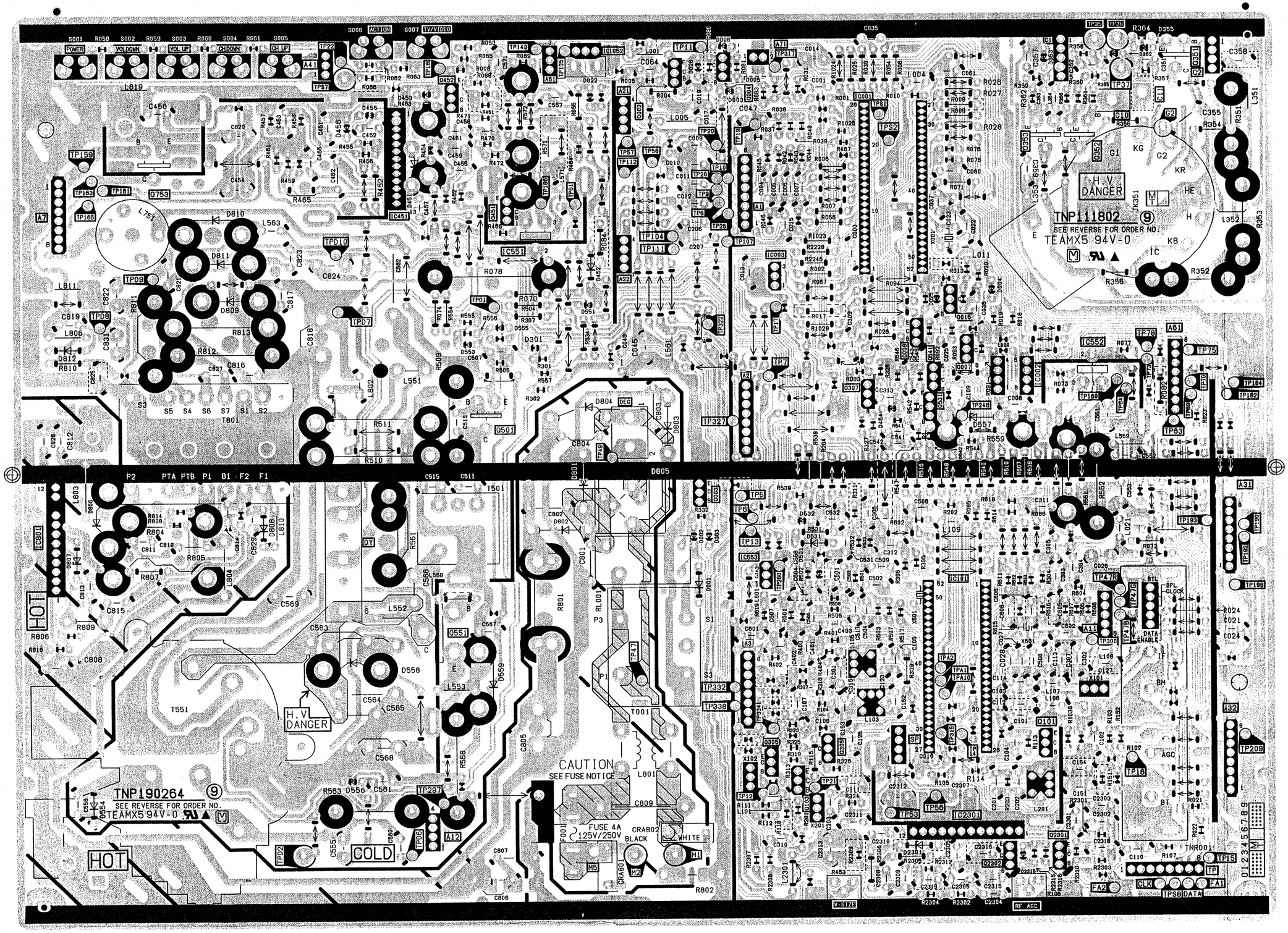

## Z–Board Schematics (31” Models only)




## Voltage Chart – Z–Board
### (For 31” Models Only)

| Transistors | | | |
|---|---|---|---|
| **Ref.** | **b** | **c** | **e** |
| Q751 | 2.9 | 9.2 | 2.4 |
| Q752 | 9.0 | 0.6 | 9.6 |

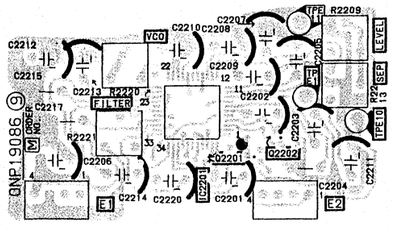
## A–Board TNP190264



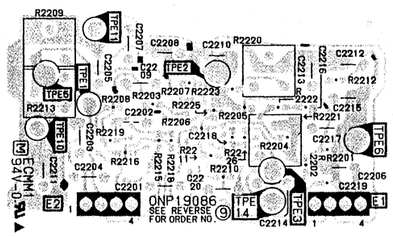

C–B

# Board Layouts (All Models)

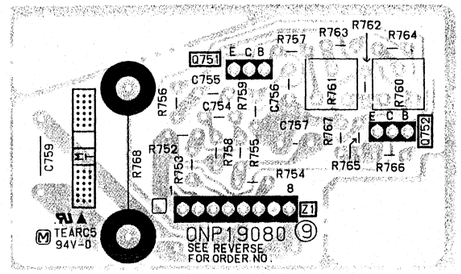
## E–Board 0NP19086 (Top side)



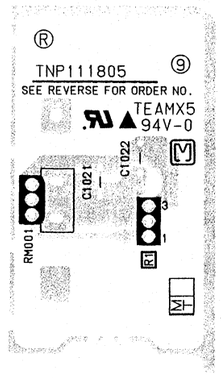

## E–Board 0NP19086 (Bottom side)




## Z–Board 0NP19080 (31" Models only)

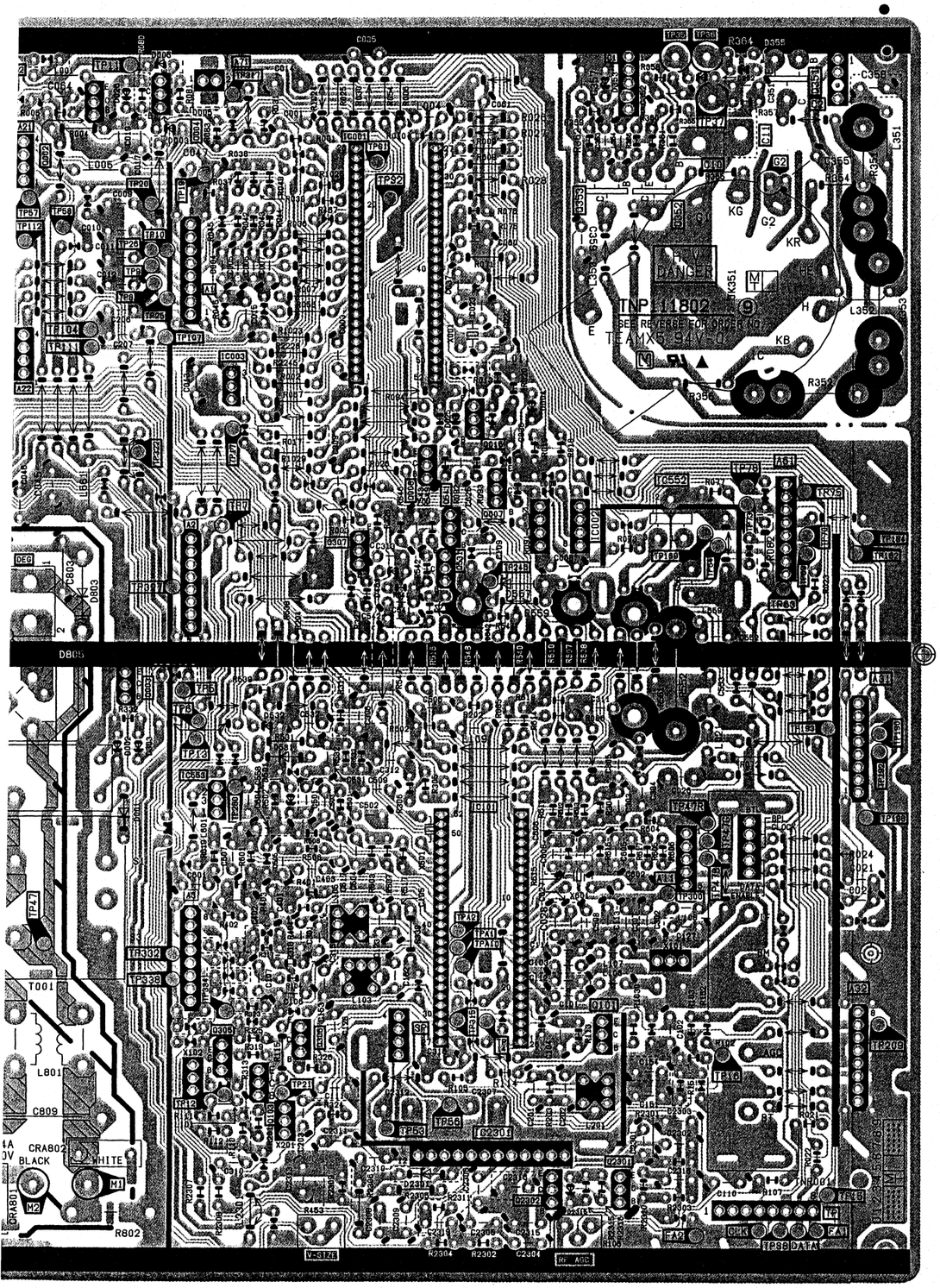



## R–Board TNP111805

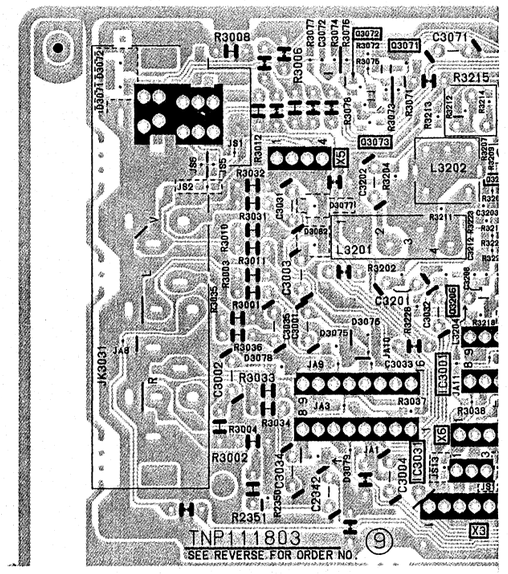


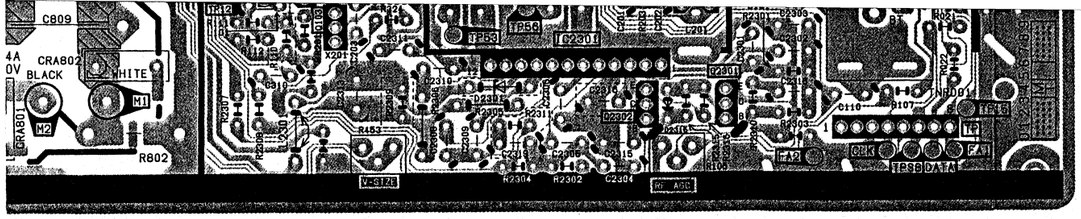
# Board Layouts (All Models)

**ard TNP190264**

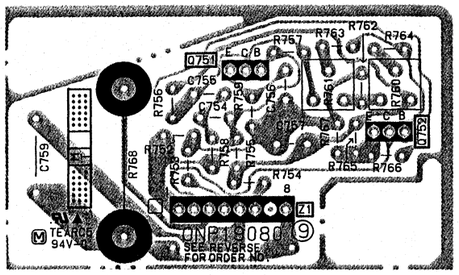



**C–Board TNP111802**

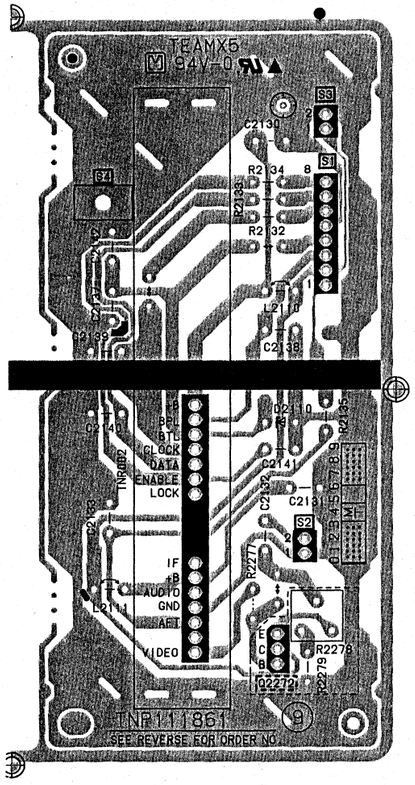




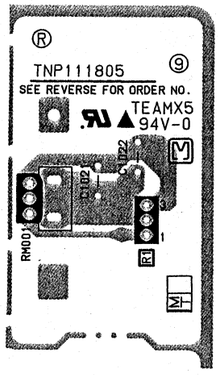

## Z–Board 0NP19080 (31” Models only)

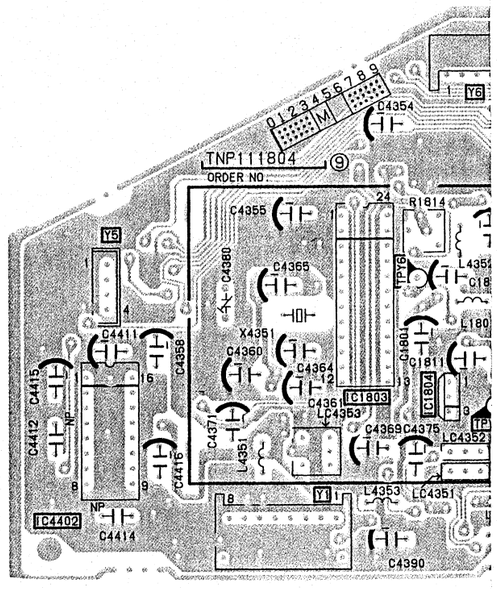



## S–Board TNP111861




## R–Board TNP111805

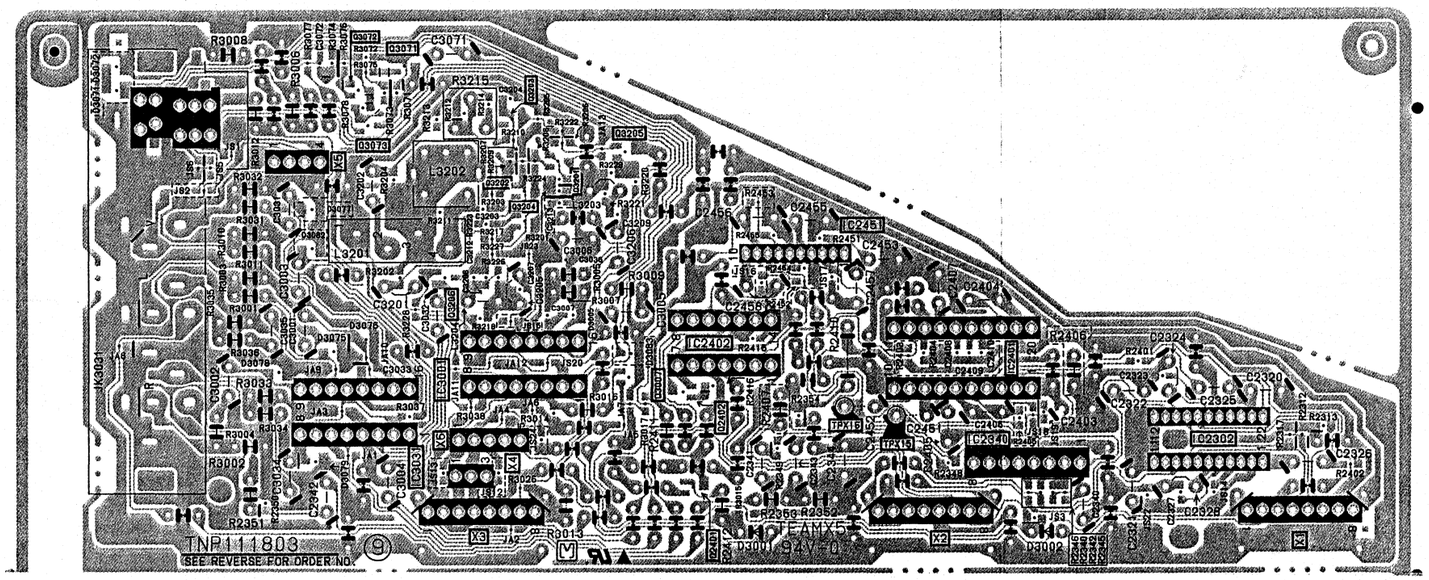



(Top side)

02

## X–Board TNP111803

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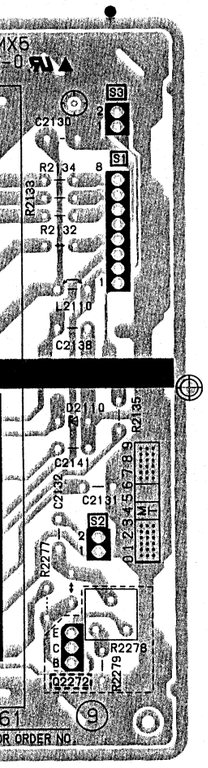
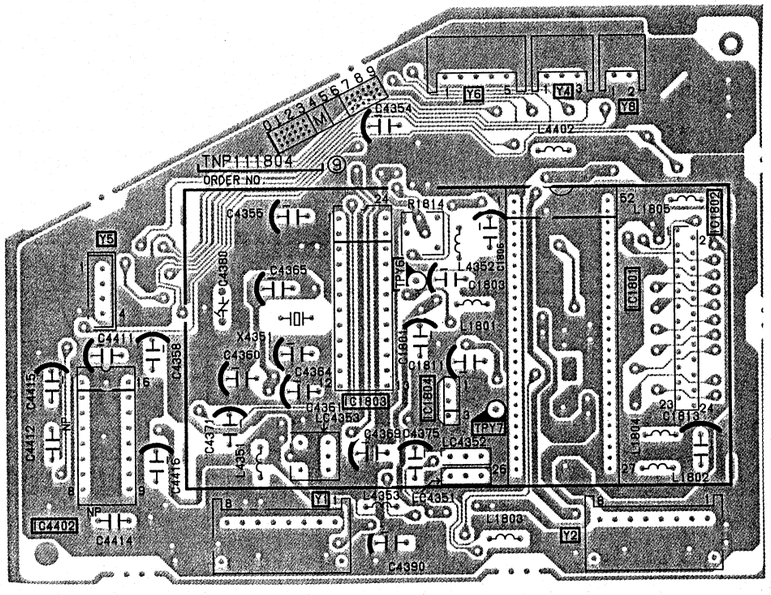
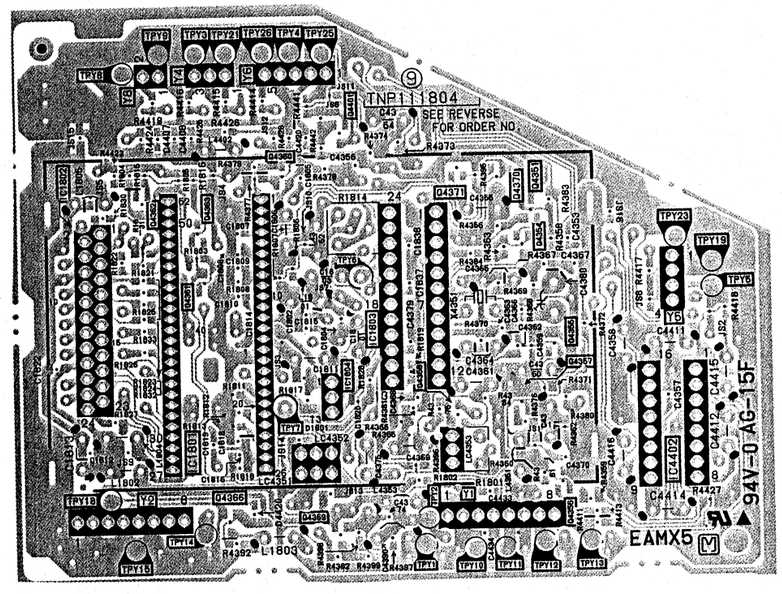
**TNP111861**




**Y–Board TNP111804**




(Top side)




(Bottom Side)